DRAFT
Environmental Impact Statement

Columbia River Mainstem
Water Management Program

December 2004

#04-11-031

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Washington Department of FISH and WILDLIFE

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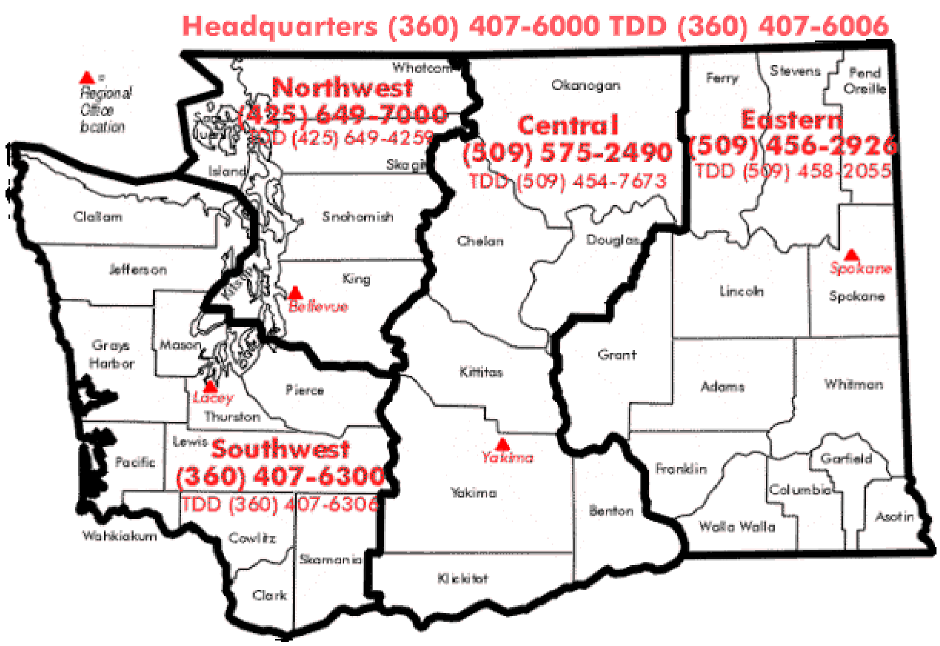

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Environmental Impact Statement

Columbia River Mainstem Water Management Program

December, 2004

Publication No. 04-11-031

Washington State Department of Ecology
Washington Department of Fish and Wildlife

Fact Sheet

Title:	Columbia River Initiative
Description:	The proposal is a water management program for the mainstem of the Columbia River, established in administrative rule, defining how the Department of Ecology will carry out its dual obligations to allocate water and preserve a healthy environment. The objective of the management program will be to meet the needs of a growing population and a healthy economy while also meeting the needs of fish and a healthy watershed. The rule is being developed through the Columbia River Initiative process. The proposal will amend and/or partially repeal the Instream Resources Protection Program for the Main Stem Columbia River in Washington State (Chapter 173-563 WAC) and the Water Resources Program for the John Day-McNary Pools Reach of the Columbia River (Chapter 173-531A WAC).
Lead Agency and Responsible Official:	Linda Hoffman, Director Washington State Department of Ecology
Person to contact for more information:	Gerry O'Keefe Department of Ecology Water Policy Team P.O. Box 47600 Olympia, Washington 98504 E-mail: CRI@ecy.wa.gov Telephone: 360.407.6640 FAX: 360.407.6989
DEIS Authors:	Andrew Kolosseus, John Monahan, Hal Beecher, John Covert, Rebecca Inman, and Gerry O'Keefe
Date DEIS Issued:	December 17, 2004
DEIS Public Comment Due Date:	Written comments on this draft environmental impact statement (DEIS) may be submitted by postal mail, facsimile, or email. All comments must be postmarked or date stamped no later than March 4, 2005.
Public Hearings:	Vancouver -- Feb. 7, 2005 7:00 p.m. Water Resources Education Center 4600 S.E. Columbia Way

Pasco -- Feb. 8, 2005 7:00 p.m.
TRAC, Sports Hall of Fame Room
6600 Burden Blvd.

Moses Lake -- Feb. 9, 2005 12:00 noon
Fire Dept. Multi-Purpose Rm.
701 E. Third Ave.

Grand Coulee -- Feb. 9, 2005 7:00 p.m.
Grand Gallery Theater
204 Main St.

Wenatchee -- Feb. 10, 2005 7:00 p.m.
Chelan Co. PUD Auditorium
327 N. Wenatchee Ave.

Lacey -- Feb. 15, 2005 7:00 p.m.
Dept. of Ecology Auditorium
300 Desmond Dr.

Colville -- Feb. 17, 2005 7:00 p.m.
Community Colleges of Spokane, Colville Center
985 S. Elm St.
East Entrance, Dominion Rm.

Proposed Date of Final Action:	Rule adoption is expected on June 10, 2005.
Proposed Date of Implementation:	The rule is expected to become effective on July 10, 2004.
Subsequent Environmental Review:	The rule together with the water management program will be reconsidered after 10 years. Any future rule-makings to revise the program must go through separate environmental review.
Location of DEIS Information:	DEIS information is available from the Department of Ecology at the address above and at Ecology's Eastern and Central Regional Offices. Additional information is also available on Ecology's website at www.ecy.wa.gov/programs/wr/cri/crihome.html.
Cost of DEIS:	The DEIS is available at no cost.

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Reference Material (these materials are available on-line at www.ecy.wa.gov/programs/wr/cri/crihome.html)

Managing the Columbia River: Instream Flows, Water Withdrawals, and Salmon Survival. A Report of the National Research Council of the National Academies. The National Academies Press. Washington, D.C. 2004.

Economics of Columbia River Initiative: Final Report to the Washington Department of Ecology and CRI Economics Advisory Committee. Daniel Huppert, Gareth Green, William Beyers, Andrew Subkoviak, and Andrew Wenzl. University of Washington and Seattle University. January 12, 2004.

Final Environmental Impact Statement for Watershed Planning under Chapter 90.82 RCW. Washington State Department of Ecology. July 18, 2003. Available on-line at: http://www.ecy.wa.gov/pubs/0306013.pdf

Summary

The purpose of this programmatic draft environmental impact statement (DEIS) is to identify and assess the potential environmental impacts of the proposed rule developed through the Columbia River Initiative and to identify and analyze reasonable alternatives and mitigation measures. A programmatic environmental impact statement provides an impartial discussion of significant environmental impacts. It is used to inform decision makers and the public of reasonable alternatives, including mitigation measures, which would avoid or minimize adverse impacts or enhance environmental quality.

The proposed rule is the primary basis for this analysis. However, the structure of the rule itself is premised on the passage of legislation proposed by Governor Locke to the 2005 Legislature. Because the scope of the Columbia River Initiative has included a wide range of policy alternatives, the DEIS will also consider, in brief, a sample of the alternatives that were a part of the discussion and debate that shaped the proposed rule and legislation.

Purpose and Need for the Proposal

Competition for water from the Columbia River continues to escalate. There are hundreds of pending applications in Washington for new water rights from the Columbia, and there is little agreement on the short and long-term effects of off-stream water use on salmon recovery efforts. Symptoms of increasing public frustration and controversy include petitions for rule-making served upon the state, the increasing reliance upon litigation to achieve policy goals, and demands for state action by local elected officials.

The department has twice been petitioned to initiate a rulemaking for the Columbia River. The first petition, filed by the Center for Environmental Law and Policy, American Rivers, the National Wildlife Federation, and the Pacific Fisheries Council proposed the closure of the Columbia and its tributaries in Eastern Washington to further appropriation. More recently, a petition filed by the Columbia Snake River Irrigator's Association, the City of Brewster, and a number of Eastern Washington legislators would have required the department to begin issuing water rights from the river.

Another important factor has been the department's experience with the existing rule governing the allocation of water rights from the river. Unfortunately, the permit by permit consultation required by the existing rule has proved to be a cumbersome and ineffective tool to support decision-making on applications for new water rights.

In light of these factors, Governor Locke chartered the Columbia River Initiative with the task of developing a new rule governing a state water management program for the river's water resources that will provide timely and affordable access to new water rights while protecting the health of the river's ecosystem.

Regulatory Framework

The statutes authorizing the agency to adopt rules for the Columbia River Initiative are Chapters 90.03, 90.22, 90.54, 43.21A, and 43.27A RCW.

Washington water law is complex and constantly evolving. Washington State has enacted and implemented major new laws addressing water conservation, growth management, water resource planning, and water resource data management. State law is likely to evolve further in the near future in light of rapid population growth, changes in priorities for water, the difficulty and cost of new water development (much of the cheap, available water is already being used), and demands to improve the health of streams through such means as the federal Endangered Species Act.

Early Water Law

Long ago acquiring the right to use water was a much simpler process. If water was available, anyone could make reasonable use of it. Since water is essential to life, most settlement and human activity occurred close to water. The riparian doctrine of water law allows for the historic reasonable use of water on land adjacent to a water source. The riparian doctrine provided a right to use water if the water source was adjacent to or within the owner's property. In times of water shortage under the riparian doctrine, all users were to curtail their water uses proportionally.

Even after the colonization of America, and subsequent United States independence, the riparian water laws continued to work quite nicely throughout the eastern portion of this country, where water was plentiful. Settlers who moved west discovered that the old water laws didn't work as well in the drier climates west of the Mississippi River. Western water use didn't always fit under the earlier riparian doctrine water laws.

The early westerners used water in new ways and on land that was distant from the water source. These westerners stopped water flow and stored it, moved it to new locations, and even found new water uses. They discovered that it was necessary to bring the water to where they needed it, rather than bring their needs to the water. This new practice of removing water from the stream and conveying it to remote new places of use became recognized in law as the appropriation doctrine. An appropriation doctrine water right is based on actual beneficial use of water, rather than date that land was separated from federal ownership.

In the earliest years of Washington statehood, if one intended to secure a water right, they posted a notice on a tree or post near the proposed point of diversion, and may have also filed a copy of the notice with the county auditor. If the neighbors did not protest, all that remained was to construct the diversion and put the water to use. However, a water right could also be established by simply constructing a water delivery system and putting the water to beneficial use without notice or recording.

It was through appropriation that the legal concept of water right priority emerged, that is in times of shortage, senior right holders have their water needs satisfied first, rather than all users sharing water proportionally. Thus the concept of "first in time, first in right" became a new component of water law in the western United States.

Washington State was one of only a few states with the "dual system" of water law: riparian and appropriation. This fragmented water right process had many problems. There was no provision to require follow-up to determine whether any or all of the water claimed through a notice of an appropriation doctrine diversion actually was put to beneficial use. In some areas, several property owners would claim the entire flow of a stream numerous times. Conflicts between water users resulted in individual lawsuits to settle disputes. Most early court cases dealing with disputes over water rights failed to identify all water users on a problem stream, unless they were named as plaintiff(s) or defendant(s). The courts also failed to sort out the legitimate rights of other water users or to comprehensively settle rights to waters of an entire water source. Clearly, the water right process had become unreliable.

Washington Water Code of 1917

In 1913 the Governor formed a commission to study the problem, culminating in the passage of the Washington Water Code of 1917. The Water Code of 1917 provided for centralized water right administration by the state. It required individuals to file an application for a permit to establish appropriative surface water rights subject to any existing rights. It directed that public notice be made of all applications with a provision for protest if someone contented an earlier right might be impaired or harmed by a new applicant's water use. Further, the water code required the state to answer four tests in making a decision on new water rights: beneficial use (not wasteful); water is available; no impairment to existing rights; and not detrimental to the public interest. The Water Code also established procedures for adjudicating all existing water rights. A general water right adjudication is a legal process conducted through the State Superior Court that determines the validity and extent of existing water rights in a given area.

The 1917 Water code did not affect existing rights, but made appropriation through a state permit system the exclusive way to establish new rights. The state initially considered that riparian water rights not perfected through actual use were terminated by the passage of the Water Code of 1917. However, a later State Supreme Court case recognized a 15-year period after 1917 for riparian rights to be put to beneficial use. For a riparian water right to be recognized by Ecology or confirmed in an adjudication, steps must have been taken to remove the riparian land from federal ownership prior to June 6, 1917, and water must have been put to beneficial use prior to December 31, 1932.

Much of Washington State's current water law, practices, and uses are based upon this 1917 law. The law written at nearly the turn of the century still is the primary governance of water use in our state, even now in 2004.

The 1945 Ground Water Code

By 1945, many people in the state were using wells to access ground water. The Legislature then enacted the Ground Water Code, establishing the same permitting process used for surface water. The Ground Water Code provided a three-year opportunity for anyone claiming an existing ground water right to declare that they had already put the ground water to beneficial use. The state then reviewed the declarations that were submitted and issued certificates of ground water right to those who qualified.

The Ground Water Code does allow an exemption to the permit requirement if someone uses a total of 5,000 gallons or less of ground water from a well each day for any of the following combinations:

- Stockwatering purposes;
- Single or group domestic purposes;
- Industrial purposes; or
- Watering a lawn or noncommercial garden that is a half-acre or less in size.

As in the case of the 1917 Water Code and surface water, the Ground Water Code is the basis for Washington's current water law, practices and uses of ground water.

The Minimum Water Flows and Levels Act of 1967

This Act provides a systematic approach to instream flow protection. Under this law, Ecology may, upon request of the Washington Department of Fish and Wildlife or of its own volition, establish minimum flows by administrative rule to protect fish, wildlife, water quality, and other instream values.

Water Rights Claims Registration

By the 1960's, the legislature realized that records for water rights established before the 1917 surface water code and the 1945 ground water code were incomplete and scattered. As a result, the state had an inadequate understanding of the amount of water being used.

The 1967 Water Right Claims Registration Act directed the then Water Resources Department to record the amount and location of these pre-code water rights by authorizing the state to accept and register water right claims. A water right claim is a statement of claim to water use that began before the state Water Codes were adopted, and is not covered by a water right permit or certificate. A water right claim does not establish a water right, but only provides documentation of one if it legally exists. Ultimately, the validity of claimed water rights would be determined through general water right adjudications.

This law also provides that water must be used under a water right or, after a period of time, the user faces losing their water right through relinquishment back to the state. The law does provide for certain circumstances under which a water right would not be subject to relinquishment. Sufficient causes include: active military service, drought conditions, court proceedings, or water use for municipal water supply purposes.

The initial statewide opening for filing water right claims ended June 30, 1974. The legislature opened the Water Rights Claims Registry three times since then. The most recent claim registration was from September 1, 1997 until June 30, 1998. When Governor Locke signed the 1997 law re-opening the claims registry, he did so with the hope that it would be the final opening and put an end to the confusion about water rights. To date, Ecology has recorded a total of about 169,000 claims in the claims registry.

The Water Resources Act of 1971

The legislature passed the Water Resources Act of 1971 to protect and manage the state's water resources for "the greater benefit of the people." This act became necessary because of the increasing conflict in water use and applications for larger amounts of water. Earlier water laws were not equipped to handle these new problems. This act mandates water resources data collection, and development and management of comprehensive basin plans.

This is the present instream flow law used to protect fish and other environmental values by setting minimum instream flow levels basin-wide before issuing new water rights. Instream flows adopted as rules are considered a water right and have as a priority date, the date of adoption of the plan as a rule.

1971 Water Well Construction Act

Today, more than 12,000 water wells are drilled each year. This legislation regulates well drilling to protect public health and safety. Water well contractors must pass a test to obtain the required license. Once licensed, well drillers must notify Ecology before a well can be drilled or dug. Well construction cannot begin unless a water right permit has been issued if required. A driller must submit a water well report to Ecology following construction of a well. By rule, Ecology may limit or prohibit well drilling for even exempt wells in areas requiring intensive control of ground water withdrawals.

1989 Water Use Efficiency Act

The Water Use Efficiency Act established water conservation as a priority consideration as a source of water. It encourages efficiency improvements, and amended the state plumbing code to require water-conserving fixtures in new construction.

Growth Management Acts

Growth management legislation, passed in 1990 and 1991, included provisions providing a clearer link between the development of land and water availability. Under these laws, an applicant for a building permit for a structure that will require drinking quality water must provide evidence of an adequate water supply for the intended use of the building.

Watershed Management Act of 1998

The Watershed Management Act provides a framework to collaboratively solve water issues. This framework is based on geographic areas known as Water Resource Inventory Areas (WRIAs), or watersheds. The act is designed to bring together local citizens, local governments, state agencies, and tribes to form planning units for the development of watershed management plans. These planning units shall assess each WRIAs water supply and use, and recommend strategies for satisfying minimum instream flows and water supply needs. The planning units may develop strategies for improving water quality and protecting or enhancing fish habitat, and in collaboration with Ecology, set instream flows. The legislature also supplied funding for grants to support these local planning efforts.

Case Law Affecting Water Rights

Several legal and policy issues have also affected water resource management in Washington. Some of these court cases are described below:

The State Supreme Court ruled in Rettkowski v. Department of Ecology (1993, commonly known as Sinking Creek) that Ecology may not attempt to resolve disputes among conflicting water uses if one or more of them is based on an unadjudicated vested claim to a water right.

The State Supreme Court in Grimes v. Department of Ecology (1993) set down important case law regarding the obligations of water users to maintain efficient water delivery and use systems that are not wasteful. The opinion also provides important criteria relating to beneficial use.

The State Supreme Court in PUD No. 1 of Jefferson County v. Department of Ecology (1993, commonly known as the Elkhorn case) ruled that Ecology could use instream flow conditions on a permit that provide a high level of protection for instream values (optimum fish flows based on state of the art studies). This case was subsequently appealed to the United States Supreme Court on other issues and resulted in a landmark opinion regarding the relationship of water quantity and quality.

The State Court of Appeals ruled in Hubbard v. Department of Ecology (1994) that the connection between ground water and surface water (referred to as hydraulic continuity) may exist even when the point of withdrawal of the ground water is several miles removed from the affected stream. It upheld Ecology's conditioning of a ground water right with instream flows in the Okanogan River, based on continuity between the aquifer and river, even if the effect of pumping on the flow of the river would be small and delayed. The decision also affirmed that where surface and ground water is connected, minimum flows established by rule are treated as appropriations and should be protected from impairment by any subsequent ground water appropriation.

The State Supreme Court ruled in Hillis v. Department of Ecology (1997) that Ecology must involve the public when making broad policy decisions on setting priorities for water rights permit decisions. That opportunity is provided through Ecology's rule-making process. The court refused to invalidate individual water right decisions Ecology made on the basis of an existing watershed assessment process. The court also found that Ecology may conduct watershed assessments, but may not make the completion of an assessment a requirement or prerequisite to making decisions on applications without first adopting rules.

In Okanogan Wilderness League v. Town of Twisp and Department of Ecology (1997) the State Supreme Court ruled that Ecology's decision granting a change in the point of diversion for the town of Twisp's surface water right was in error because the water right had been abandoned and was therefore no longer valid. Municipal water rights, while not subject to relinquishment, remain subject to loss through abandonment. The State Supreme Court also held that only the quantity of water that has been put to actual beneficial use is valid for change under an existing water right. In reviewing change and transfer applications, Ecology must first determine the quantity that has been put to historical beneficial use under the existing water right, and then determine that the right was never relinquished or abandoned.

The State Supreme Court ruled in Department of Ecology v. George Theodoratus (1998) that Ecology is authorized to place new conditions on extensions for water right permits and to issue certificates for water rights only when and to the extent that the water is put to beneficial use.

Goals and Objectives of the Columbia River Initiative

Governor Locke, in chartering the Columbia River Initiative, established two goals for a new water resources management program. First, a new program must meet the water supply needs of growing communities and the local economies on which they depend by providing a timely and affordable supply of water that will allow for new and reliable uses of water from the Columbia River mainstem. Second, a program must protect and enhance the quality of the natural environment, including stream flows necessary for the preservation of environmental values by securing and dedicating water to improve stream flows in the river mainstem.

The state has established three objectives for the program. First, it should to improve the reliability of water rights issued by the Department of Ecology between 1980 and 2003 that are subject to minimum instream flows or other mitigation conditions to protect stream flows. Second, it should result in improved stream flows during the primary period of fish out-migration on the mainstem. Finally, it should mitigate for the stream flow impacts of future water right permits issued under the program.

Summary of the Proposal

To adequately address the scientific recommendations of the National Academy of Sciences, the proposed rule is designed to meet the water needs of growing communities and economies along the mainstem of the Columbia River, but to do so in a manner that reduces the risk to fish resulting from out-of-stream use of water. To achieve this objective, the state's governance of the river's water resources must find middle ground, relying on science to help frame an approach that meets the needs of the community of affected stakeholders.

Consistent with legislation proposed by Governor Locke, the proposed rule establishes an administrative framework necessary to implement a water resources management program that contributes water to the Columbia River mainstem in sufficient quantity and at the appropriate times to meet both the identified water supply needs of the Columbia Basin and reduce the risks imposed upon salmon over a 20 year period.

Other actions taken by the Governor in addition to the proposed rule covered by this analysis include: the policy legislation; capital and operating budget requests; and, a set of negotiated water agreements with various partners.

History of the Columbia River Initiative Process

Soon after endangered species listings for salmon on the Columbia River were announced in 1990, the state suspended issuing rights for new withdrawals from the Columbia River, after determining that a new analysis of the effects of further water allocations was needed.

As a result, new requests for water were put on hold. In 1998, legislation lifted the moratorium and an interim rule was adopted to guide the state on making new water-right decisions until more was learned about fish and stream-flow requirements.

Commonly known as the "consultation rule," it calls for Ecology to confer with pertinent cities, counties, tribes, and state and federal agencies before allocating more water from the Columbia River. The rule has been challenged on a number of fronts and, as one judge put it, has proved to be "unworkable."

The failure of the consultation rule to establish a workable framework to manage the issues associated with new water allocations is demonstrated by the record of rule-making petitions that have since been served upon the state. Beginning in 2000, two separate petitions were filed that, if adopted, would have had dramatically different effects. The first, filed by the Center for Environmental Law and Policy, American Rivers, and the National Wildlife Federation would have closed the Columbia and its Eastern Washington tributaries to further appropriation of water. The second, filed by the Columbia Snake River Irrigators Association, the City of Brewster, and a number of Eastern Washington legislators would have required the department to begin issuing new water rights from the river.

In this context, Governor Locke chartered the Columbia River Initiative. His direction to state agencies was to develop a new water resources management program for the river that would provide water for economic and community develop purposes without harming endangered salmon populations.

To achieve a thorough, independent scientific analysis of this question, the state asked the National Academy of Sciences to prepare a report on the risks new water withdrawals might pose for fish and what could be done to manage those risks.

The state also commissioned an economic analysis of Columbia River water use. Natural resource economists from the University of Washington reviewed existing literature and reported on what new water allocations might mean to the region's economy.

After receiving reports from these two prestigious groups, the state developed an informal management framework and began to involve interested parties in a discussion of the issues and a draft solution. Through the spring and summer of 2004, state staff regularly met with interested parties to respond to questions and improve the draft based upon feedback. The current proposed rule is the result of this process.

Hearings on the proposed rule will be held to collect formal comments in February 2005. Assuming passage of the requested policy legislation, adoption of a final rule would occur in June 2005 and the rule should become effective in July 2005.

Summary of Alternatives

This DEIS addresses two alternatives in-depth:

1. The no action alternative; and,
2. The preferred alternative

Under normal circumstances, the DEIS would address a range of options to be considered by the agency as a part of developing the proposed rule. In this case, however, the existence of policy legislation establishing the framework for the new water resources management program leaves the agency in the position of implementing the framework established by the Legislature. In order to reflect the diversity of options considered during the Columbia River Initiative's the DEIS will also address a set of policy alternatives that were discussed and evaluated as a part of the public process associated with the development of the proposed management program under the Columbia River Initiative.

The No Action Alternative

The state would retain the existing "consultation" rule as the basis for making water rights decisions affecting the Columbia River. The Department of Ecology is currently required to consult with fish managers and other interests on a case by case basis prior to making water right permit decisions. Mitigation for each permit issued by the department is determined through the process of consultation. Given the recent history of litigation associated with water rights issued under the existing rule, it is likely to take years to resolve current litigation the outcome of which is uncertain.

The Preferred Alternative

The primary feature of the preferred alternative is an accounting framework for tracking, allocating, and retaining instream, waters of the Columbia River. The rule proposal would facilitate the implementation of the accounting system to track water that is acquired through efficiency investments, management changes at existing storage facilities, development of new, multi-purpose storage, and purchase of existing water rights. As provided by associated legislation, for every three buckets of new water that is acquired, two buckets may be allocated for out of stream use. The remaining bucket would be preserved instream to reduce the risks to fish. Another important feature of the preferred alternative is the setting the amount of mitigation payments, water use metering and reporting, and water use efficiency standards (Best Management Practices or BMPs).

The preferred alternative is designed to implement the provisions of the requested policy legislation.

Summary of Significant Impacts

The DEIS addresses the potentially significant impacts of the no action alternative and the proposal. The DEIS addresses impacts from allocating water from the Columbia River on the river itself and the surrounding environment. As water is allocated, the economy is expect to expand and the population is expected in increase. For example, land use patterns may change and a growing population may increase the demand on public services and utilities.

Summary of Mitigation Measures

Under the state's rule proposal, water use is directly offset by acquisition of new water sources that are available instream during the critical season established in the National Academy of Sciences report (April through August). Upon implementation, the preferred alternative would result in more water in the river during the period of water use. As a result, other mitigation measures such as removal of barriers to habitat or habitat restoration are not evaluated in detail.

Documents Incorporated by Reference

Pursuant to provisions WAC 1970-11-635 of the State Environmental Policy Act Rules, the following documents are incorporated by reference into the Columbia River Initiative Draft Environmental Impact Statement:

Managing the Columbia River: Instream Flows, Water Withdrawals, and Salmon Survival. A Report of the National Research Council of the National Academies. The National Academies Press. Washington, D.C. 2004.

> **Summary of Document:** As part of the Columbia River Initiative, the Department of Ecology secured a formal and independent review of the existing science related to fish survival and hydrology in the Columbia River. This review was conducted through the National Academy of Sciences, under contract with the state. As part of the national science review, regional scientists were asked to contribute information and expertise. The report provided guidance for framing water management scenarios under the Columbia River Initiative. A draft of the report is available on-line at: http://www.ecy.wa.gov/programs/wr/cri/crinsr.html. Hard copies can be obtained from the National Academies Press.

Economics of Columbia River Initiative: Final Report to the Washington Department of Ecology and CRI Economics Advisory Committee. Daniel Huppert, Gareth Green, William Beyers, Andrew Subkoviak, and Andrew Wenzl. University of Washington and Seattle University. January 12, 2004.

> **Summary of Document:** The University of Washington conducted an economic review of the value of water for various Columbia River mainstem uses. The economics report analyzes what impacts new water withdrawals from the Columbia River might have on the state's economy in relation to agricultural production, municipal and industrial water supplies, hydropower generation, flood control, river navigation, commercial and recreational fishing. The report also looks at issues related to water markets and water exchange transactions. Information from the economic study, along with the National Academy Science Report and other information developed by the CRI, is being used to will help the agency craft a new management program for the Columbia River. The report is available on-line at: http://www.ecy.wa.gov/programs/wr/cri/crieconrev.html.

Final Environmental Impact Statement for Watershed Planning under Chapter 90.82 RCW. Washington State Department of Ecology. July 18, 2003. Available on-line at: http://www.ecy.wa.gov/pubs/0306013.pdf

> **Summary of Document:** This Final Environmental Impact Statement describes the watershed planning process set forth in the Watershed Planning Act, as well as procedures for rule making that may be undertaken by state agencies to support implementation of watershed plans. It describes the existing framework of federal, state, and local laws, regulations, and programs that affect, or are related to management of watersheds. In addition, it evaluates the impacts of and identifies mitigation measures for various types or classes of recommended actions that may be included in watershed plans including municipal, industrial, and agricultural conservation measures; water banking and transfer mechanisms; water allocation strategies; instream flow requirements; water quality restoration and enhancement measures; and various approaches to fish habitat improvement. The Final Environmental Impact Statement is available on-line at: http://www.ecy.wa.gov/pubs/0306013.pdf.

Alternatives

An EIS is a tool for identifying and analyzing a proposal's probable significant adverse environmental impacts, reasonable alternatives and possible mitigation. A reasonable alternative is a feasible alternate course of action that meets the proposal's objective at a lower environmental impact. Reasonable alternatives may be limited to those that an agency with jurisdiction has authority to control either directly or indirectly through the requirement of mitigation. The State Environmental Policy Act also requires evaluation of the no-action alternative, in other words what would be the impact if no change was made. In this case, that would mean that no new water management program would be developed, current rules would not be repealed or amended, and the Department of Ecology would be left with the current regulatory framework.

When making a final decision on the Columbia River Initiative rule, Ecology will consider the analysis in the Final EIS and comments received on the Draft EIS for all of these alternatives.

Alternatives Not Addressed in EIS

The alternatives discussed in this section reflect elements of the public discussion that has occurred since the release of the report of the National Academy of Sciences. These alternatives reflect choices that are inconsistent in some way with the goals and objectives of the Columbia River Initiative established by Governor Locke. They are provided as additional context for decision-making.

Close the River to New Withdrawals

One alternative that is not being addressed in this EIS is closing the river to new withdrawals of water. This alternative would require the state to adopt a new moratorium rule on new water use from the Columbia River.

Closing the river to further allocations would have many consequences. The alternative would not be expected to positively or negatively affect current water quality or other environmental factors. However, closing the river would restrict additional economic development and population growth in areas dependent upon the river for water supplies. Agriculture, industry, and municipalities would all be affected if no additional water is available in the future, imposing constraints on the state's economy, as demonstrated by the University of Washington's economic report.

One of the two goals established by the Governor for the Columbia River Initiative is to meet the water supply needs of the Columbia basin by improving the reliability of existing rights and making water available for pending and new applications for water. A decision to close the river to all new withdrawals fails to address this goal.

Establish a Minimum Instream Flow

Under state law, a minimum instream flow is an appropriation of water necessary for the protection of perennial streams and rivers within Washington. It establishes a water right with many of the same attributes as other water rights issued by the state by clearly identifying a purpose for the flow, a location or stream reach to which the flow applies, and a priority date. A minimum instream flow is adopted in an agency rule and establishes a regulatory basis for restricting the use of water by the holders of permits issued after the instream flow is adopted into rule.

Ecology adopted a minimum instream flow for the Columbia River mainstem in 1980. These minimum flows currently apply to approximately 330 water right permits that were issued before 1998. Recognizing the extensive use of the river by numerous private and public power and reservoir facilities throughout the Columbia River basin, Ecology's 1980 rule provided that out-of-stream water users would be restricted when weekly minimum flows were not met only if the seasonal (April 1 to October 1) runoff forecast was below 60 million acre feet (MAF). If this threshold volume of runoff water was exceeded, then any weekly flows below the state flow targets were the result of federal power operations, not the use of water by the permitted water users, and therefore not subject to regulatory intervention by the state. The adopted minimum instream flows, when combined with the seasonal flow forecast as a trigger mechanism for curtailing out-of-stream users, resulted in a class of water rights that can be expected to be curtailed, on average, once every 26 years.

Since 1991, when the National Marine Fisheries Service (now NOAA Fisheries) proposed the first salmonid listing on the Snake and Columbia River system, there have been extensive scientific efforts directed toward a better understanding of the relationship between the life stages of listed species and flows in the mainstem of the Columbia River. Although individuals within the scientific community have produced multiple descriptions of that relationship, a common element is that reductions in flow are recognized to contribute to reduced survival of salmon smolts during the out-migration period. The strength and significance of that relationship is, however, a subject of considerable scientific debate. For these reasons, Ecology contracted with the National Academy of Sciences / National Research Council (NRC) for an independent assessment of the risks to Columbia River fisheries by potential future permitting actions by Ecology.

The NRC concluded that increased water diversions by holders of existing state and federal rights in Washington and other states (as well as future permits that might be issued within

Washington), when combined with other environmental factors, would pose substantial additional risks to Columbia River salmon populations during the months of July and August.

However, the NRC was not asked and did not provide the kind of detailed analysis that would be needed to establish new instream flows for the Columbia River. Given the content of the NRC's report, it appears unlikely that a scientific consensus exists upon which a minimum flow to protect salmon would be based. As a result, the state lacks the data necessary to set a new instream flow for the river.

Minimum flows are confounded by the operations of the Federal Columbia River Power System (FCRPS). Daily electrical load following actions by the FCRPS result in large swings in streamflows; swings that sometimes surpass 100,000 cubic feet per second in volume. Large flow changes, both up and down, can occur more than once in a day. These system operations occur under authority of federal law. Under the existing circumstances it would be reasonable to expect that regulatory interruption of water use on a regular basis. This scenario would effectively render infeasible many water use applications.

The state rule would lack the authority to affect the underlying cause of reduced streamflows, resulting in perverse regulatory interventions against water users authorized under state law.

The lack of an adequate and credible scientific basis for a minimum flow rule effectively eliminates the state's ability to set a new minimum flow for the Columbia. Even if data were available, the complications that result from the operation of the FCRPS -- and the limitations of state authority to interfere with federal mandates -- leads to a conclusion that new minimum instream flows would have little chance of meeting the economic or environmental goals of the Columbia River Initiative.

Issue Water Permits without Mitigation Requirements

Research and modeling conducted by Dr. James Anderson of the University of Washington Columbia Basin Research argues that temperature, not streamflows, is the primary factor affecting the survival of salmon smolts. Furthermore, the model developed by Dr. Anderson shows only minute effects on salmon survival correlated with decreasing streamflows. Based on this view, some stakeholders assert that state mitigation for water use in the amounts contemplated by the Columbia River Initiative (485,000 acre feet of water for out-of-stream uses) would not have a significant effect on salmon populations. As a result, any state mitigation designed to offset the effects of water use on salmon would be unnecessary.

The basic problem for the state in this case is the divergence of this alternative model from the report issued by the National Academy of Sciences. Despite hearing a presentation from Dr. Anderson and having access to this research, the committee that developed the Academy's report reached quite different conclusions. In short, the report concludes that water withdrawals are likely to result in substantial risks to salmon during the months of July and August as:

- water is appropriated by other states, Canada, and Indian tribes;

- water temperatures increase as streamflows decrease and global warming occurs; and,
- population increases require additional water use in Washington.

As a result the Academy advised the state to take a cautious approach to allocating additional water from the river. The preferred alternative reflects the state's attempt to reduce the risks to salmon as a part of establishing a new water management program for the Columbia River.

Issue New Water Rights with Expiration Dates

The National Academy of Sciences concluded that any new state water management program should grant the state the flexibility to reduce water use if it becomes clear that salmon are directly threatened by it. This conclusion, while logical, is inconsistent with current water rights administration by the state and, in particular, would introduce new uncertainties affecting the financial viability of agricultural businesses. For this reason, the agricultural community does not believe that term permits offer a viable mechanism to improve reliability of water rights.

No Action Alternative

Description and Discussion

In the no-action alternative, the existing rule governing the water resources of the Columbia River would require consultation with fish managers (WDFW, Tribes, and NOAA Fisheries) prior to allocating new water rights. Under this scenario, the type and quantity of any mitigation that might be required is a decision that is made for each permit on a case by case base following the required consultation.

Under this alternative, in order for Ecology to issue a new water right, the four tests as stipulated in Chapter 90.03 RCW must be met:

- The water must be available for allocation;
- The water must be proposed to be put to a beneficial use;
- Use of the water must not impair existing water rights; and
- Use of the water must not be contrary to the public welfare.

Additional allocations of water would reduce surface water flows. Reductions in flow may affect salmon survival and other aquatic and riparian habitat. Substantial reductions in flows may also result in long-term increases in water temperature.

Taking no action may result in an inability to meet future water demands for both instream and out-of-stream needs. Taking no action in regard to water quantity leaves many resource management concerns unanswered. Continued growth and allocation of water rights under existing programs may result in continued decreases in stream flow.

Applications for new water rights would face a very uncertain future. Issuing a water right without a comprehensive plan would increase the scientific uncertainty. This uncertainty, in turn, would increase the legal obstacles of issuing a defensible new water right.

The Preferred Alternative

Description and Discussion

The proposed rule is designed to meet the water needs of growing communities and economies along the mainstem of the Columbia River in a manner that reduces the risks to fish that result from out-of-stream use of water. Consistent with pending legislation, the state has proposed a set of actions necessary to implement an efficiency and acquisition program that contributes water to the Columbia River mainstem in sufficient quantity to both meet the identified water supply needs of the Columbia Basin and reduce the risks that fish face over a 20-year period. The actions proposed by Governor Locke include the proposed rule covered by this DEIS, capital and operating budget requests, and a set of negotiated water agreements.

Proposed Legislation

The legislation requested by Governor Locke will establish the policy parameters underpinning the proposed Columbia River rule. To implement the water resources management program in a manner consistent with the requested legislation, the department would be required to:

1. Acquire water prior to, and in mitigation for, decisions to authorize new uses of water from the Columbia River mainstem;
2. Secure and deposit two-thirds of the acquired water into the mainstem account for allocation as mitigation water for new water uses through a state mitigation program;
3. Secure and deposit one-third of the acquired water into the mainstem account for permanent allocation to improve stream flows; and,
4. Authorize new uses of water from the Columbia River mainstem consistent with the requirements of the Program.

Proposed Rule

To establish an administrative framework consistent with the requested legislation, the proposed rule:

1. Establishes the management guidelines for the Columbia River Mainstem Water Management Account (Account) under the State trust water rights program, chapter 90.42 RCW. The Account is a mechanism to manage water to mitigate for potential impacts from new uses of water from the Columbia River mainstem and to provide water for instream uses;
2. Requires Ecology to appoint an Administrator for the Account;
3. Sets priorities for allocation of water from the Account;

4. Establishes requirements and procedures for issuance of drought permits to complement existing interruptible rights on the Columbia River mainstem that are subject to the minimum instream flows set in WAC 173-563-040;
5. Establishes requirements and procedures to secure a reliable supply of water for holders of water rights on the Columbia River mainstem issued in 2003 and for applications for new water rights to Columbia River mainstem surface waters that have been pending since 1991;
6. Establishes requirements and procedures for issuance of new surface and ground water rights from the Columbia River mainstem for applications currently on file with the Department of Ecology (Department), and for any future water right applications affecting the Columbia River mainstem;
7. Establishes a value (per acre foot per year) for contracts with water right permittees to partially offset the cost of acquiring mitigation water for the program.

In conjunction with the proposed Columbia River Mainstem Water Management Program rule, the Department will concurrently propose conforming amendments to Chapter 173-563 WAC and Chapter 173-531A**.** The existing instream flow rules and water use interruption requirements, and the existing water right application consultation process, will both be amended. Once amended, these current rule provisions will be applicable only to water right applications processed prior to the effective date of the new Columbia River rule.

These elements describe the core of the proposed rule, and as such, are the basis upon which the DEIS is developed.

In large part, the proposed rule is designed to implement the legislation proposed by Governor Locke. As result, the benefits of the proposal include implementation of the legislation and the start of processing new applications for water. Conversely, a failure to adopt the proposed rule (assuming passage of the policy legislation) would effectively close the river to further appropriation. It is unlikely that the agency could sustain this position once the policy legislation is signed into law.

Mitigation Payments

The proposal requires the agency to establish the value of mitigation payments water permittees would be required to make annually based on water use. The agency's decision regarding the value of these payments could have a significant effect on the benefits that accrue to citizens as a result of the rule. A decision to set the value of the payments at a level that cannot be supported by the water-based economy would sharply limit applications for water use and, as a result, economic returns to citizens. On the lower end, the value of payments is marked by a judgment regarding an appropriate contribution by permittees toward the cost of acquiring water to support the water management program. The Department of Ecology would have responsibility for striking a balance within this range.

While establishing the value of mitigation payments is the most significant decision left to the agency by the proposed legislation, the effectiveness of the water management program is not dependent upon this decision. Water must be acquired prior to issuing new water rights. In this manner, the rule protects the natural environment from negative impacts that might otherwise result from out-of-stream water use.

Process Details

Water in the Account may only be allocated by the Department from an upstream source to downstream uses. Upstream uses may not benefit from downstream sources of mitigation water. The Department will maintain the Account so that the balance in the offstream portion is greater than zero.

Water will be deposited into the Account in accordance with existing laws for water right changes, amendments, and transfers, and through agreements, contracts, assignments, and other instruments that ensure a reliable source of water based on valid state water rights and state laws.

Potential sources of water for the Account include, but are not limited to:

- Implementation of water conservation measures;
- The development of new or expanded multipurpose storage of water;
- Changes in management of existing storage projects;
- Acquisition of existing water rights, in part or whole, through purchase or donation.
- Water contributed to the Columbia River as a result of water management actions taken within Columbia River tributaries; and,
- Saved water returned to the State from water right holders who choose to implement best management practices.

The Department will obligate water from the offstream portion of the Account for new water uses by sub-basin, in accordance with the priority date of the water right, as reflected by the date of application.

Amount of Water

The estimated current and future offstream needs for water are in Figure 1. The estimated 485 KAF of water for offstream uses would result in 243 KAF of water permanently held in trust solely for instream uses. A total of 728 KAF of water would be deposited into the account (485 KAF + 243 KAF) to meet these needs over the 20-year life of the rule.

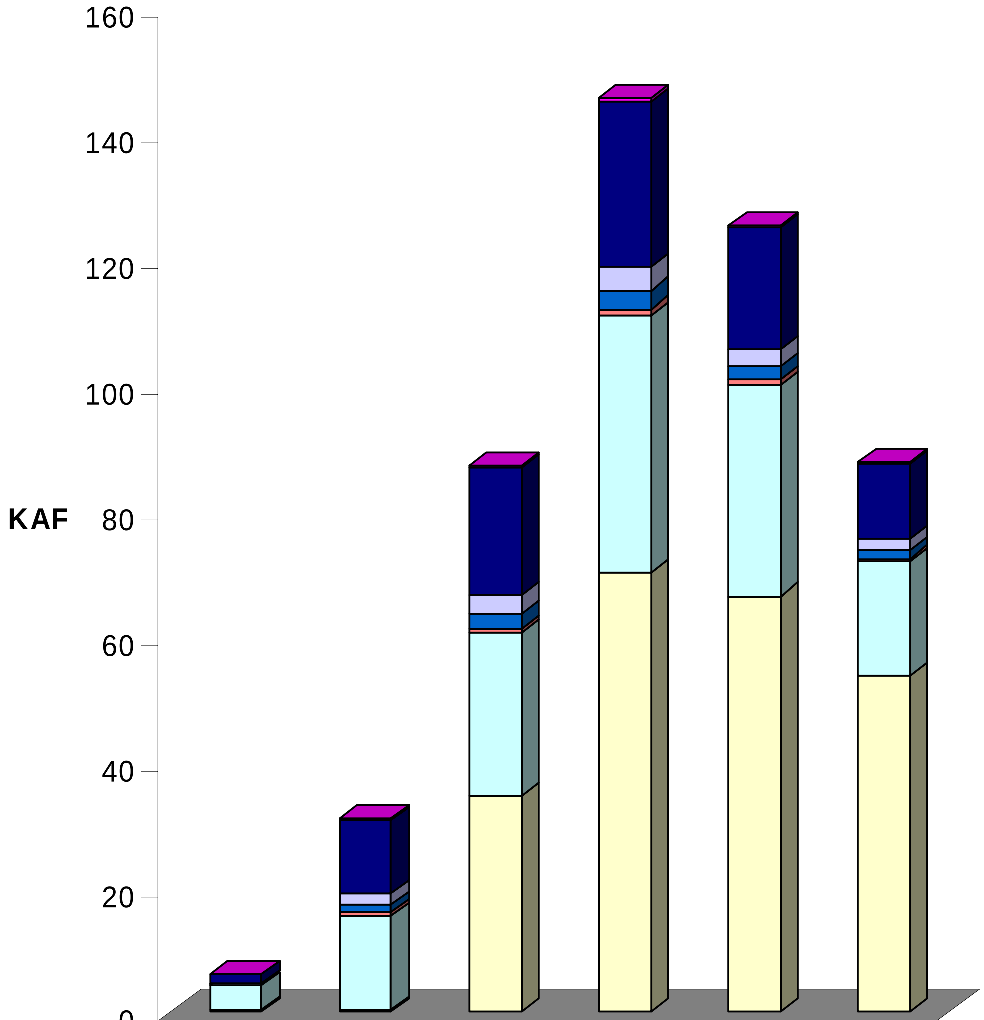
Figure 1. Estimated Offstream Water Needs

	Estimated amount of water need to meet the offstream needs for:			Amount of instream water to reduce the risk to fish	Grand Total
	Irrigation	Municipal and Industrial	Total of Irrigation, Municipal and Industrial		
Drought permits to complement interruptible water rights	29 KAF	4 KAF	33 KAF	17 KAF	50 KAF
Permits issued in 2003	39 KAF	89 KAF	128 KAF	64 KAF	192 KAF
Pending Applications	237 KAF	33 KAF	270 KAF	135 KAF	405 KAF
Future Growth	47 KAF	7 KAF	54 KAF	27 KAF	81 KAF
Total	352 KAF	133 KAF	485 KAF	243 KAF	728 KAF

Water withdrawn from the Columbia River could occur between the Canadian border and the Bonneville Dam (river mile 146). The most significant withdrawals would be from the John Day and McNary pools.

Water withdrawals from the Columbia River would be greatest during July and August. During these months, water needs for irrigation as well as municipal and industrial needs are higher. Figure 2 shows the predicted water withdrawals, by month, for the Columbia River Initiative. (The amount of water used per month is based on existing patterns of water use by municipal, industrial, and agricultural users. The amount of water from each pool is based on Huppert, 2004.)

Figure 2. Predicted water withdrawals – Monthly New Water Distribution by Pools



	April	May	June	July	August	Sept
Chief Joseph	0.0203	0.1618	0.2817	0.3633	0.2654	0.1663
Wells	1.4753	11.7563	20.4616	26.3886	19.2827	12.0841
Rocky Reach	0.2112	1.6830	2.9293	3.7778	2.7605	1.7299
Rock Island	0.1684	1.3422	2.3361	3.0128	2.2015	1.3797
Wanapum	0.0506	0.4032	0.7017	0.9050	0.6613	0.4144
Priest Rapids	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
McNary	3.8236	15.0277	25.8882	41.0735	33.7732	18.2622
John Day	0.2914	0.3552	34.4988	69.9963	66.2374	53.5393
Dalles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bonneville	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Month

Affected Environment

The environmental landscape of Washington State varies widely from region to region. A general description of portions of the existing natural and built environments within Washington State relevant to the Columbia River Initiative follows.

Earth

Bisecting Washington State is the geologically complex Cascade Range. This range separates western Washington from eastern Washington. The most prominent geographic feature in the southeast portion of the state is the Columbia Plateau. The plateau is an extensive basin formed by numerous basalt flows. The Columbia and Snake Rivers flow through deeply incised trenches cut into the plateau largely as a result of the Missoula Floods that occurred during the last ice age. Portions of southeast Washington are occupied by fertile, windblown dust called loess.

The northeast portion of the state is occupied by several mountainous areas including the Okanogan Highlands, the Kettle River Range, and the Selkirk Mountains, a portion of the Rocky Mountain Range. The southeast corner of the state is elevated by a portion of the Blue Mountains.

Air

Eastern Washington Climate

The eastern part of Washington State has a relatively cool and dry climate. Many portions of eastern Washington receive less than 10 inches (25 centimeters) of total annual precipitation, and much of that precipitation falls in the form of snow. Total precipitation approaches 20 inches (50 centimeters) per year in areas closest to the Cascade Range and the Selkirk Mountains.

Precipitation increases dramatically near the Cascade Mountains and other mountain ranges in eastern Washington. Palmer, a site approximately 20 miles west of the Cascade crest, receives an annual average of 90 inches (225 centimeters) of precipitation. In an average year, Snoqualmie Pass, located at the Cascade crest, receives a water equivalent of 104 inches (260 centimeters) of precipitation, although much of that precipitation falls in the form of snow. Spokane, at the eastern edge of the Columbia Plateau, receives approximately 20 inches of precipitation per year.

Temperature ranges in eastern Washington are more extreme than those areas of Washington State moderated by the North Pacific offshore currents and associated warm maritime air masses. Characteristic eastern Washington average maximum temperatures in July are in the mid-80s (F) to near 90 degrees (F). Average minimum temperatures in July are generally in the mid- to upper 50s (F). Average maximum temperatures in January are in the low to mid-30s (F), except in southeast Washington where the average maximum temperatures are closer to 40 degrees (F). Average minimum temperatures in January are typically in the teens to mid-20s (F).

Climate Change

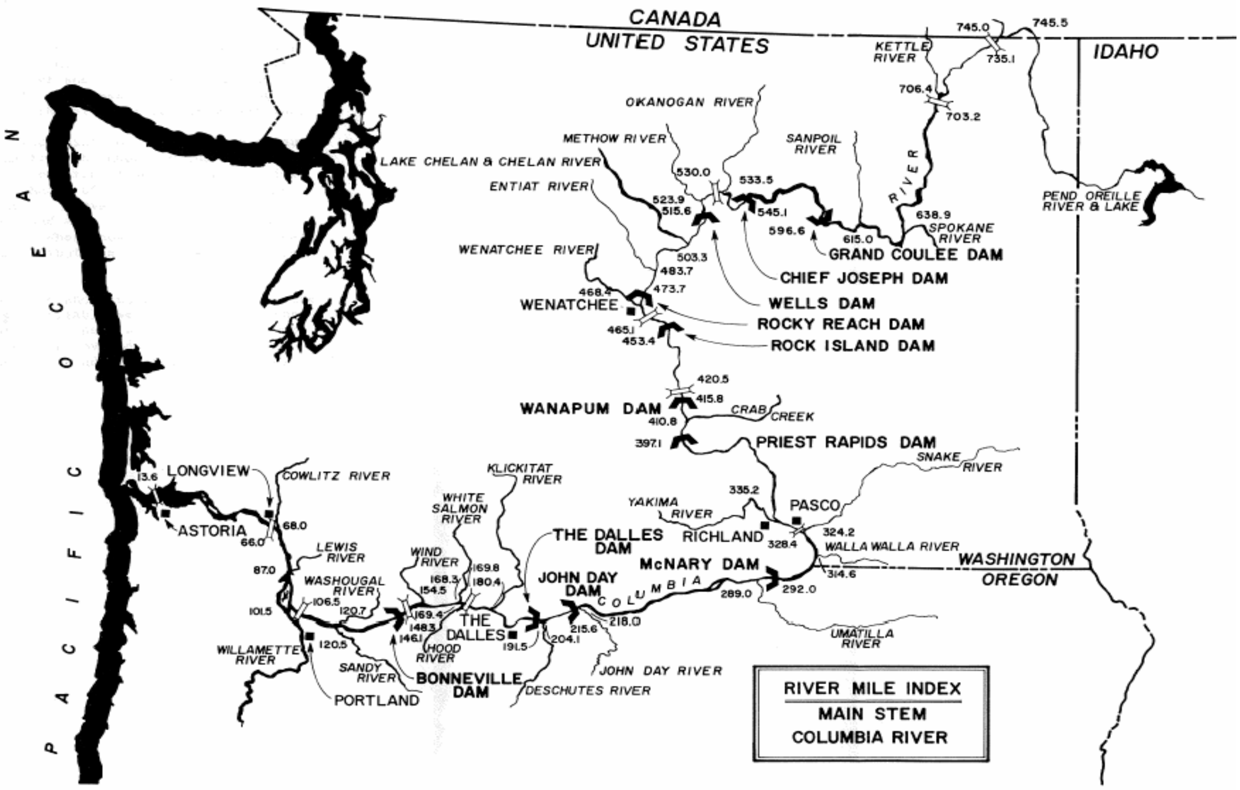
A number of scientific assessments have concluded that the Earth's average temperature will likely increase during the 21st century (Hamlet et al. 2001). Climate models used in these assessments predict that both temperature and precipitation will significantly increase in the Pacific Northwest over the next 50 years. The potential consequences to water resources in the Pacific Northwest associated with warmer temperatures, greater precipitation, and a shift in winter precipitation type from snow to rain include reduced snow packs, higher winter stream flows and concomitant increased flood potential, earlier snowmelt generated peak flows, and lower summer flows (Hamlet et al., 2001). Similarly, rivers fed by glacial melt waters may be adversely affected by climate change. Pronounced reductions in the volume of and amount of area covered by glaciers can result in significant reductions in the amount of water released to downstream rivers (Environment Canada 2003).

Surface Water

Freshwater - Rivers and Streams

The Columbia River, the largest river in the western United States, drains the eastern portion as well as part of the southwestern portion of Washington. Because of the large volume of water conveyed by the Columbia River and substantial elevation drops along its course, a number of hydroelectric dams have been constructed on the river, including 11 in Washington State. As such, many reaches of the Columbia are controlled pools or reservoirs behind dams, such as Franklin D. Roosevelt Lake behind Grand Coulee Dam. The largest tributary of the Columbia, the Snake River, is also highly developed for hydroelectric power generation with four dams in operation within Washington State alone.

Figure 3. The Columbia River



Other major tributaries of the Columbia River in eastern Washington, listed from upstream to downstream (river mile in parentheses), include the Pend Oreille (735.1), Kettle (706.4), Colville (661.0), Spokane (638.9), Sanpoil (615.0), Okanogan (533.5), Methow (523.9), Chelan (503.3), Entiat (483.7), Wenatchee (468.4), Crab Creek (410.8),Yakima (335.2), Walla Walla (314.6), Klickitat (180.4), White Salmon (168.3), and Little White Salmon (162.0) river systems. Washington tributaries of the Columbia River in the reach flowing from the Cascade Range Divide to the Pacific Ocean include the Wind (154.5), Washougal (120.7), Lewis (87.0), Kalama (73.1), Cowlitz (68.0), Elochman 39.1), and Grays (20.8) river systems. Oregon tributaries of the Columbia River in the reach between the confluence of the Snake River and the Pacific Ocean include the Umatilla River (289.0), John Day River (218.0), Deschutes River (204.1), Hood River (169.4), Sandy River (120.5), and the Willamette River (101.5).

Flow in river systems tributary to the Columbia River is primarily determined by the amount and type of precipitation that falls during winter months. Precipitation that falls during the remainder of the year is typically returned to the atmosphere through evaporation and transpiration by plants. Flows in rivers whose headwaters are at relatively low elevations and that are located in areas where winter temperatures are above freezing for most of the winter and are dominated by rainfall patterns. They respond quickly and directly to rainfall events and generally have a strong winter peak in their annual flow pattern (hydrograph).

Precipitation feeding rivers whose headwaters are at relatively high elevations and/or are located in areas where winter temperatures are below freezing for most of the winter falls predominantly in the form of snow. Generally, flows in such rivers are low during the winter, but peak strongly in spring and early summer corresponding to snowmelt within their watersheds. Most eastern Washington rivers, including the east-slope Cascade rivers, exhibit this flow pattern. However, rivers that are fed by glacial melt water, in addition to snow pack, will exhibit a different flow pattern. Glaciers can contribute a considerable amount of flow to rivers during late summer and early fall after the snow pack has melted and when precipitation is normally low.

Development of hydropower projects on the mainstem of the Columbia River radically altered the flow regime of the river during the twentieth century. Reservoir storage projects constructed watershed-wide, principally between the 1930s and the mid 1970s, have created an active storage capacity in excess of 46 million acre-feet (MAF). This is equivalent to 1/3 of the mean annual flow of the river (as measured at The Dalles, Oregon). This storage capacity can be found in four projects in excess of 5 MAF each, six projects in the 1 – 4 MAF range, and dozens of smaller projects.

The USGS has been measuring discharge in the Columbia River mainstem and its tributaries for over one hundred years. They have been collecting continuous flow measurements at a site on the mainstem at The Dalles, Oregon since the late 1870s. This long period of record allows the comparison of flow records between the pre-dam era and the post-dam construction era. The first mainstem dam was completed at Rock Island in 1933. It is a run-of-the-river facility with an active storage capacity of only 7,500 acre-feet. The last of the mainstem Columbia projects was completed in 1973 at Mica Dam in British Columbia. It has an active storage capacity of 12 MAF. The last of the Snake River hydropower projects was completed in 1975 at Lower Granite Dam.

As these storage projects came online, they had a profound affect on the Columbia River hydrograph. Figure 4 depicts the 50% exceedance curve for an equivalent pre-dam and post-dam period. In the pre-dam era, the river typically had relatively low flows during the fall and winter (October through March) period and much higher flows during the snowmelt runoff period which occurs in the spring and summer (April through September). In the post-construction era, the flows have been flattened out with relatively higher flows in the winter (tapping the stored water for power generation) and lower summer flows (as reservoirs are refilled with the snowmelt runoff – providing flood control).

Figure 4. Pre-dam versus Post-dam Mainstem Flows (Columbia River at The Dalles)

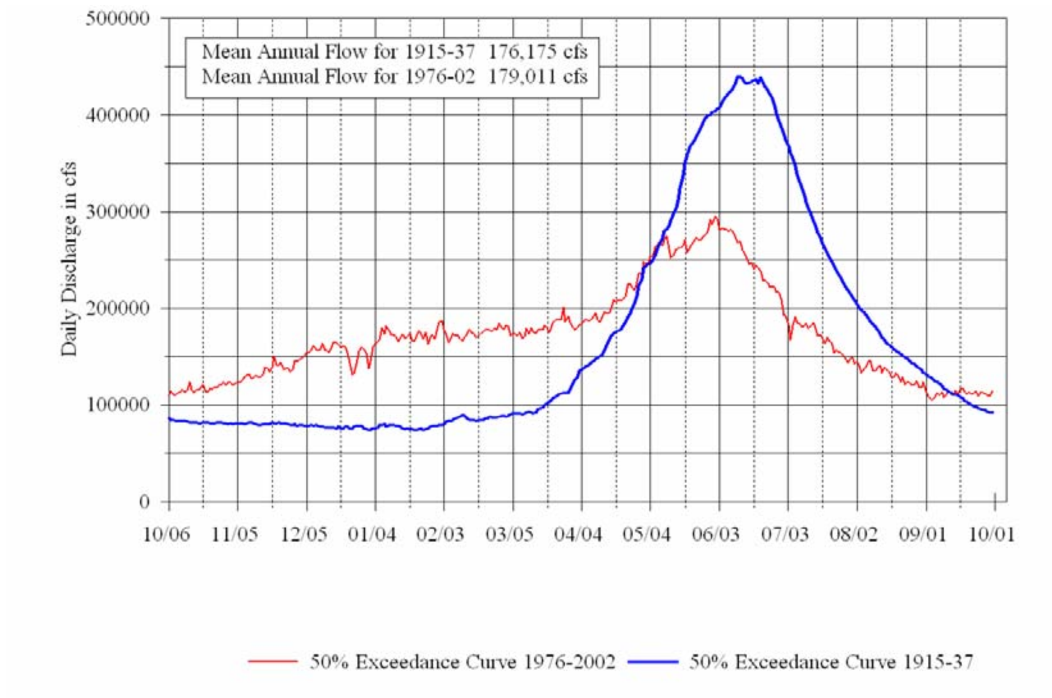
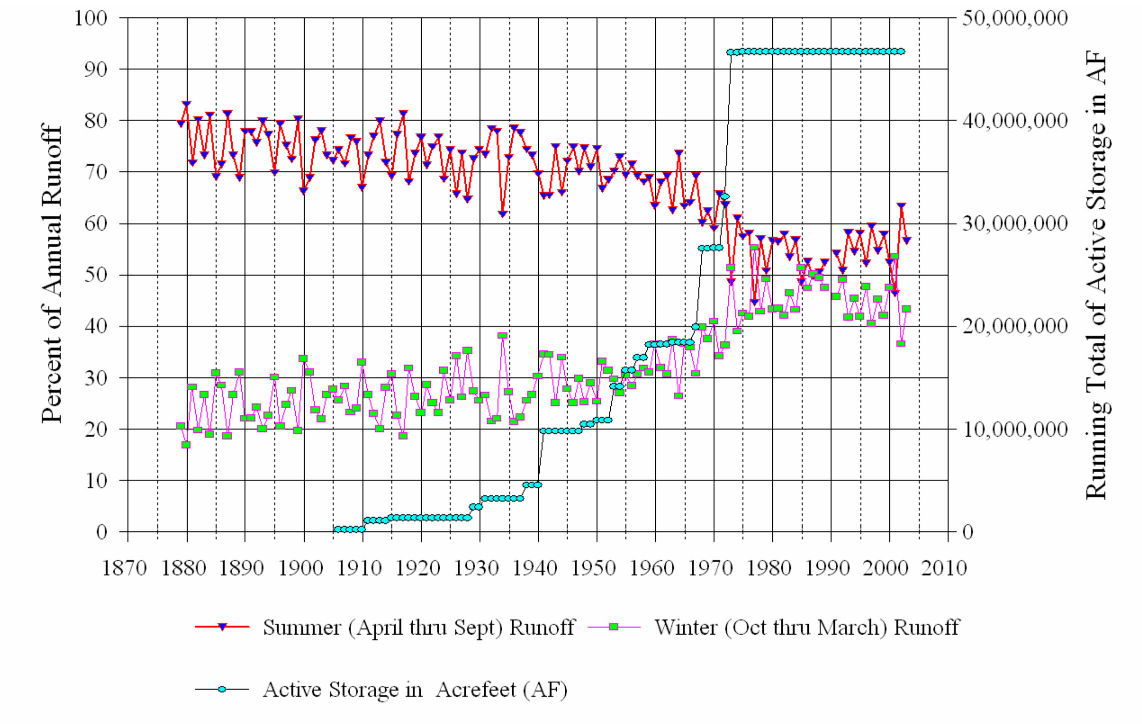


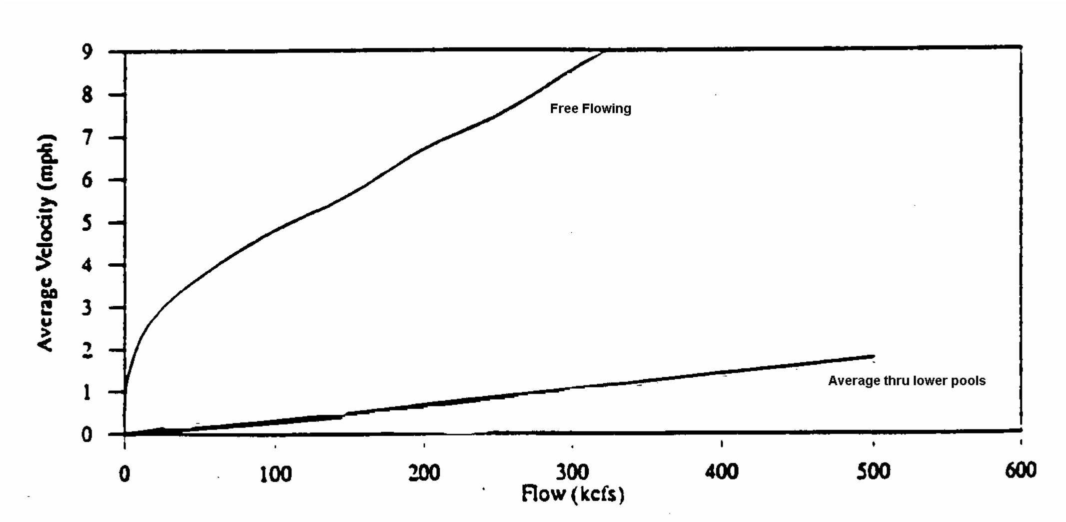
Figure 5 shows how the balance of flows between summer and winter has changed since the late 1800s. In the pre-dam era, 75% of the mean annual flow came through the system during the April through September freshet while the winter snow pack melted. As reservoir storage came on-line, the timing of the annual flow was redistributed to its current status with approximately a 50:50 split between winter and summer runoff.

Figure 5. Change in the Columbia River Hydrograph at The Dalles USGS Gage



While these changes in the annual hydrograph have been dramatic, they are not the only changes that have had a profound effect on the hydrology of the river. Water particle velocity has been dramatically lowered by the development of the hydropower/reservoir system. The velocity of the water flowing through the pools in the river today is typically a small fraction of the velocity that it had for an equivalent flow in the pre-dam era. Discharge (flow) is equal to velocity times cross-sectional area of the stream channel. In the pre-dam era, the river had a relatively large velocity in a small area (the original river channel). Today, the same discharge occurs with a small velocity flowing through a large cross-sectional area (a reservoir pool). This velocity/flow relationship can be seen in Figure 6, which was adapted from “The Biological and Technical Justification for the Flow Proposal” (Columbia Basin Fish and Wildlife Authority, February, 1991). This graph depicts the average water particle velocity in miles per hour versus flow in cubic feet per second (cfs) for the lower Columbia River for both the free flowing (pre-dam) condition and the reservoir (post-dam construction) condition.

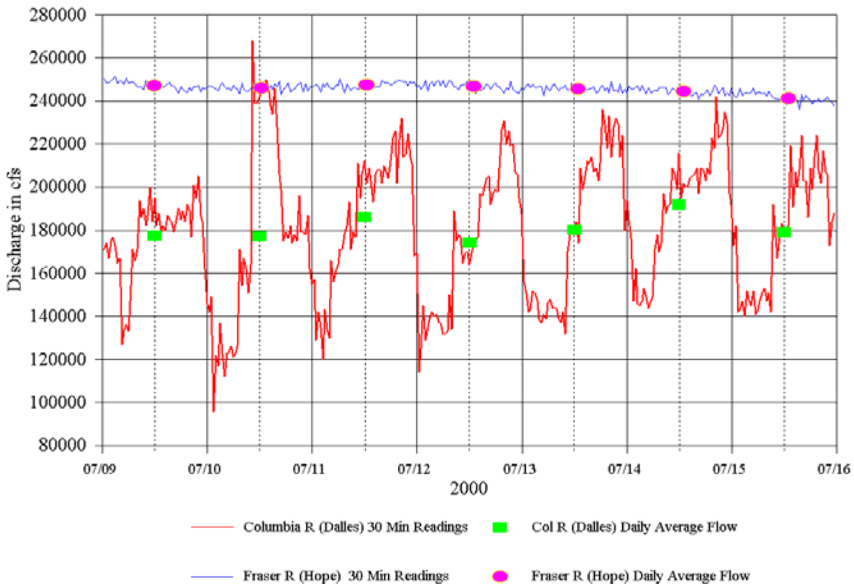
Figure 6. Velocity/Flow Relationship for the Lower Columbia River



The size and orientation of the freshwater plume flowing into the Pacific Ocean has also been greatly altered (Ebbesmeyer and Tangborn, 1992). These physical impacts to the flow regime are particularly important to the out-migration of young salmon smolts.

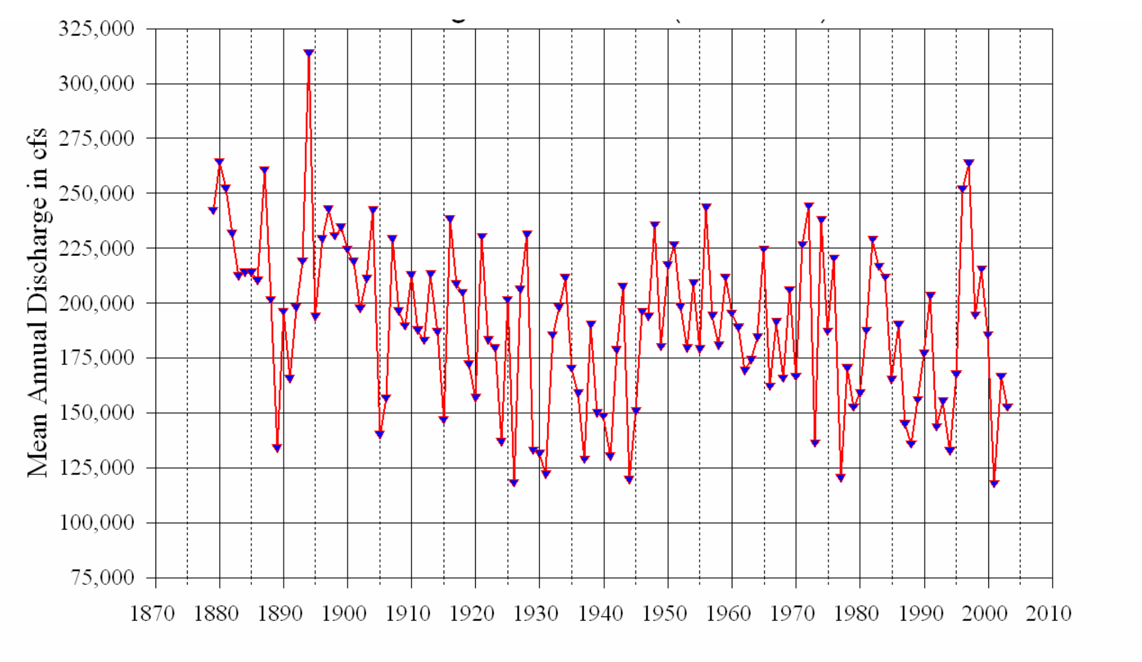
Real-time flow in the river is today dramatically different than it was in the pre-dam era. Daily flow patterns below hydropower dams vary substantially as flows are adjusted to meet demands in electric power generation. Figure 7 depicts the real-time (30 minute readings) flow measured in the Columbia mainstem at The Dalles with the same time period as measured in the unregulated, free-flowing Fraser River in British Columbia. While discharge through The Dalles can vary hundreds of thousands of cfs over the course of a single day, the flow in the Fraser is much steadier, as would be expected in an unregulated, free-flowing river.

Figure 7. Real-Time Flow Regime for the Columbia River (at The Dalles) versus the Fraser River (at Hope)



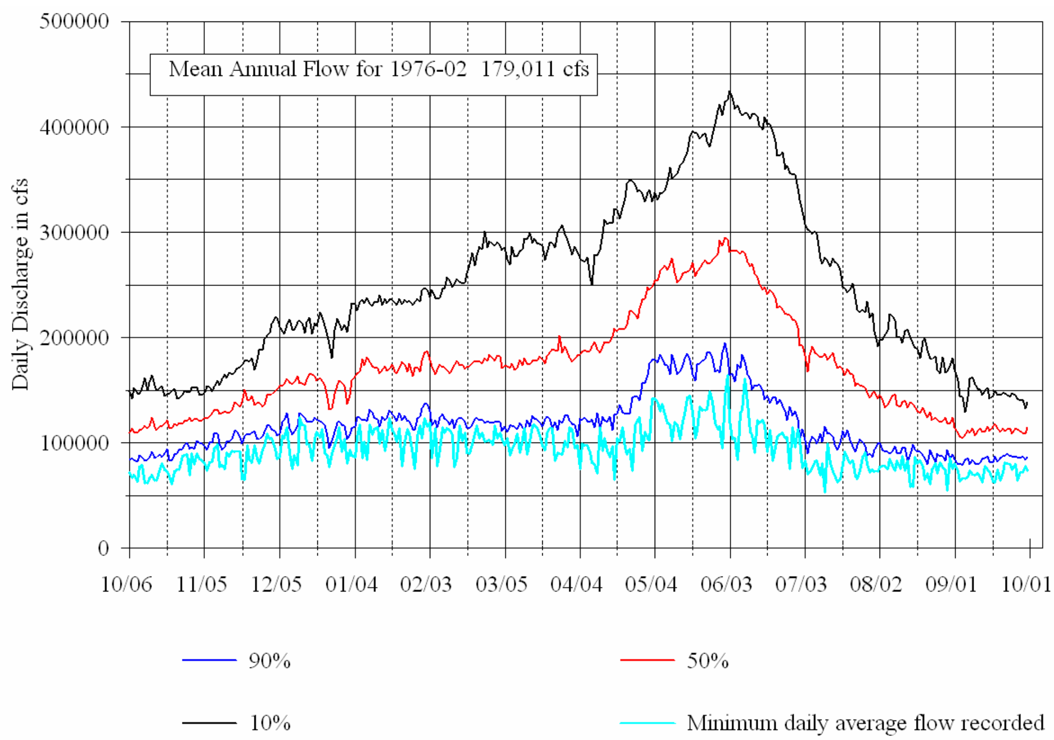
These changes, however dramatic, have not eliminated all variability of Columbia River flows. The Columbia River drains more than 200,000 square miles of territory in seven western states and British Columbia and is subject to wide climatologic variability. Figure 8 depicts the mean annual flow as recorded at The Dalles by the USGS since the late 1800s. The standard deviation for the mean annual flow (~37,000 cfs) for the period of record is greater than the combined mean annual flows of the Pend Oreille and Spokane Rivers.

Figure 8. Columbia River Mean Annual Flow (USGS Gage at The Dalles)



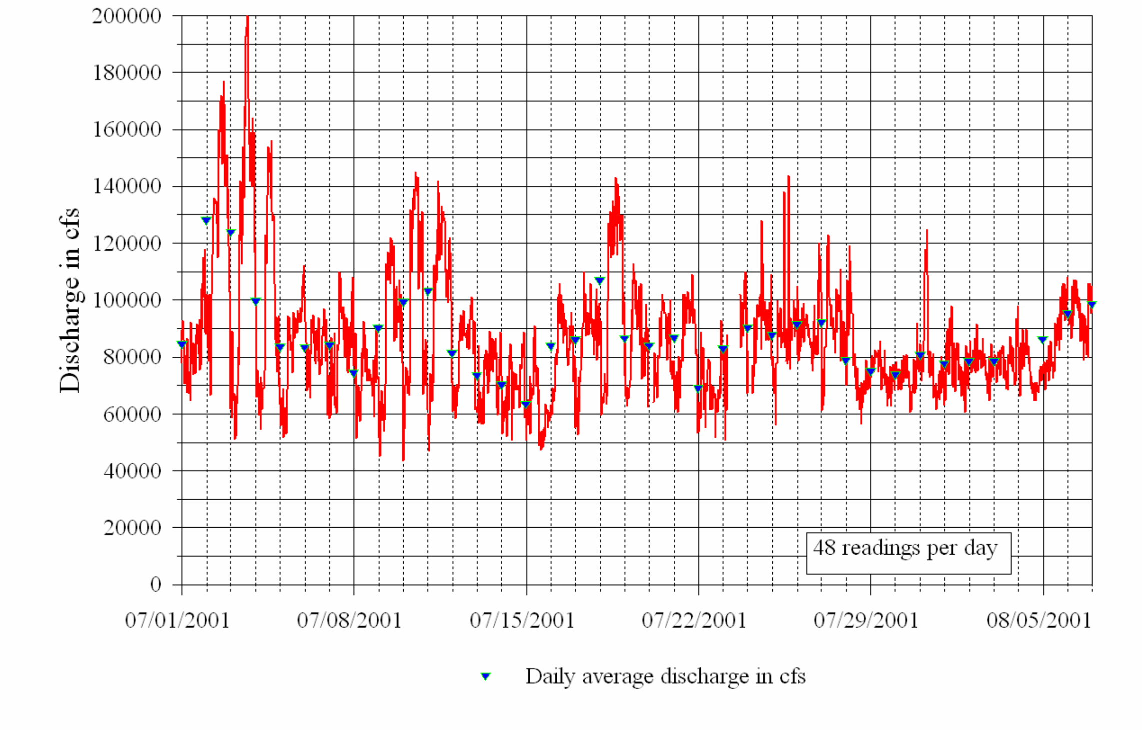
During the summer months when water use is at its highest rate and salmonids are using the river system to migrate to and from the ocean, flow in the river reaches its annual minimum value. Figure 9 depicts the 90%, 50%, 10% exceedance curves for the river at The Dalles, Oregon gage for the post-dam construction period (1976 – 2002). Also depicted on the graph is a curve representing the minimum flow observed on each day of the water year for that date for the 27 year period. As would be expected, these minimum observed flows approximate the 90% exceedance curve (nine times out of 10 the flow is higher than that value). The lowest flows measured in the lower Columbia River have daily flows of just over 60,000 cfs.

Figure 9. Columbia River (at The Dalles) Exceedance Curves (1976-2002 Water Years)



Instantaneous flows would occasionally be even lower, given the power generation demands mentioned above. Figure 10 depicts the real-time flow data collected during July 2001 (one of the driest years on record in the Columbia basin). The lowest daily average flow for the summer of 2001 occurred on July 15 and was 63,100 cfs.

Figure 10. Columbia River (at The Dalles) Real-Time 30-Minute Discharge Data



The nature of the water management program established by the rule will result in changes in the timing of water releases from both U.S. and Canadian storage facilities. Should new storage capacity be developed, additional reshaping of streamflows can be expected to occur, primarily retention of winter flows for release in the summer. The science review provided by the National Academy of Sciences and other analyses support the notion that the critical period for water management occurs in the summer as a result of low flows. By extension, the river's ecosystem is unlikely to suffer significant adverse effects as a result of implementing this approach.

Freshwater - Lakes

The state has numerous fresh water lakes, the largest of which is Lake Chelan, an approximately 55-mile long glacial lake in north central Washington. The state's lakes include naturally formed lakes, constructed reservoirs on rivers and streams, and natural lakes that are artificially raised and/or controlled through constructed impoundments. Lakes are typically fed by water from in-flowing rivers or creeks, but may also be fed by ground water and direct precipitation. In the Columbia Basin, another source of water for some lakes is irrigation return and active piping of water. An example of a lake fed in this manner is Billy Clapp Lake and there are others.

Surface Water Quality

In 1998, Ecology submitted a federal Clean Water Act section 303(d) list to the U.S. Environmental Protection Agency (EPA) identifying surface waters that the department had determined to be out of compliance with water quality standards. The Columbia River was listed for temperature, dissolved oxygen, fecal coliform, total dissolved gas, and a number of toxics (Ecology 2002).

- *Temperature*

Water temperature can be elevated above natural conditions by a number of human activities. Point sources such as municipal waste treatment plants and pulp and paper mills discharge thermal energy directly to the river. Non-point sources such as agricultural run off discharge to the rivers primarily via irrigation canals and tributaries. Dams alter river temperature by changing the flow regime, stream geometry, current velocity, and flood plain interactions of the river. The dams appear to be the most significant human-influenced cause of warming in the Columbia River. Finally, withdrawing water from the river can indirectly affect water temperature.

Water temperature is an important element for the health and survival of native fish and aquatic communities. Temperature can affect embryonic development, juvenile growth, adult migration, competition with non-native species, and the relative risk and severity of disease.

The water quality criteria for temperature are in the water quality standards at WAC 173-201A. It states:

Columbia River from mouth to the point where the river ends its run defining the Washington-Oregon border (at river mile 309.3) and turns north into Washington:

- Temperature shall not exceed a 1-day maximum (1-DMax) of 20.0°C due to human activities.
- When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed 0.3°C due to any single source or 1.1°C due to all such activities combined.

From Washington-Oregon border (river mile 309.3) to Priest Rapids Dam (river mile 397.1):

- Temperature shall not exceed a 1-DMax of 20.0°C due to human activities.
- When natural conditions exceed a 1-DMax of 20.0° C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed $t=34/(T+9)$.

From Priest Rapids Dam (river mile 397.1) to Grand Coulee Dam (river mile 596.6):

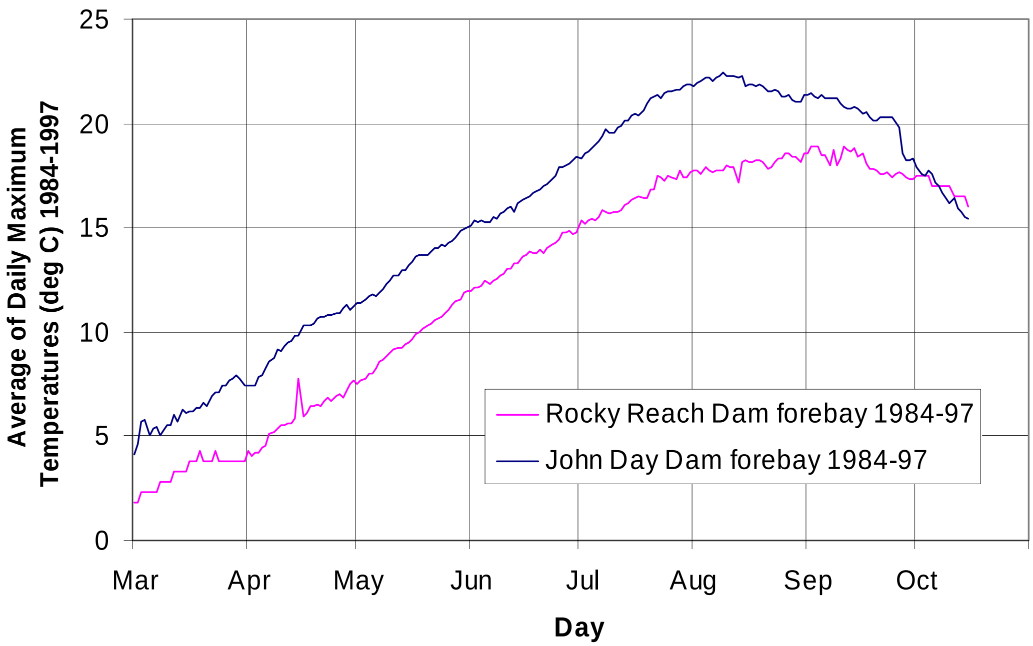
- Temperature shall not exceed a 7-DADM of 17.5°C.
- When a water body's temperature is warmer than 17.5°C (or within 0.3°C of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the 7-DADMax temperature of that water body to increase more than 0.3°C (0.54°F).

Columbia River from Grand Coulee Dam (river mile 596.6) to Canadian border (river mile 745.0):

- Temperature shall not exceed a 7-DADM of 16°C.
- When a water body's temperature is warmer than 16°C (or within 0.3°C of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the 7-DADMax temperature of that water body to increase more than 0.3°C (0.54°F).

The temperatures for the Rocky Reach Dam forebay and John Day Dam forebay are in Figure 11. The temperatures are the daily maximum temperatures averaged for each day for the period of 1984-1997.

Figure 11. Average of Daily Maximum Temperatures on the Columbia River as Measured at Two Dam Forebays



- *Total Dissolved Gas*

Spill events at dams can elevate total dissolved gas (TDG) to levels that violate state standards. Water plunging from a spill entrains air and carries it to a depth where hydrostatic pressure forces gas into solution at high levels. High TDG can cause "gas bubble trauma" in fish, which can cause chronic or acutely lethal effects, depending on TDG levels and length of exposure. A spill can be caused by several conditions. A "voluntary" spill is provided to meet juvenile fish passage goals. An "involuntary" spill is caused by lack of powerhouse capacity for river flows. An involuntary spill can result from turbine maintenance or breakdown, lack of power load demand, or high river flows.

The water quality criteria for TDG are in the water quality standards at WAC 173-201A-200(f). It states:

Aquatic life total dissolved gas (TDG) criteria. TDG is measured in percent saturation. Total dissolved gas shall not exceed 110% of saturation at any point of sample collection.

(i) The water quality criteria established in this chapter for TDG shall not apply when the stream flow exceeds the seven-day, ten-year frequency flood.

(ii) The TDG criteria may be adjusted to aid fish passage over hydroelectric dams when consistent with a department approved gas abatement plan. This plan must be accompanied by fisheries management and physical and biological monitoring plans. The elevated TDG levels are intended to allow increased fish passage without causing more harm to fish populations than caused by turbine fish passage. The following special fish passage exemptions for the Snake and Columbia rivers apply when spilling water at dams is necessary to aid fish passage:

- TDG must not exceed an average of 115% as measured in the forebays of the next downstream dams and must not exceed an average of 120% as measured in the tailraces of each dam (these averages are measured as an average of the twelve highest consecutive hourly readings in any one day, relative to atmospheric pressure); and
- A maximum TDG one hour average of 125% must not be exceeded during spillage for fish passage.

The TDG levels from three different years are in Figures 12, 13 and 14. 1997 was a high flow year, 2001 was a low flow year, and 2003 is the most recent year with data and was a more typical year.

Figure 12. Total Dissolved Gas

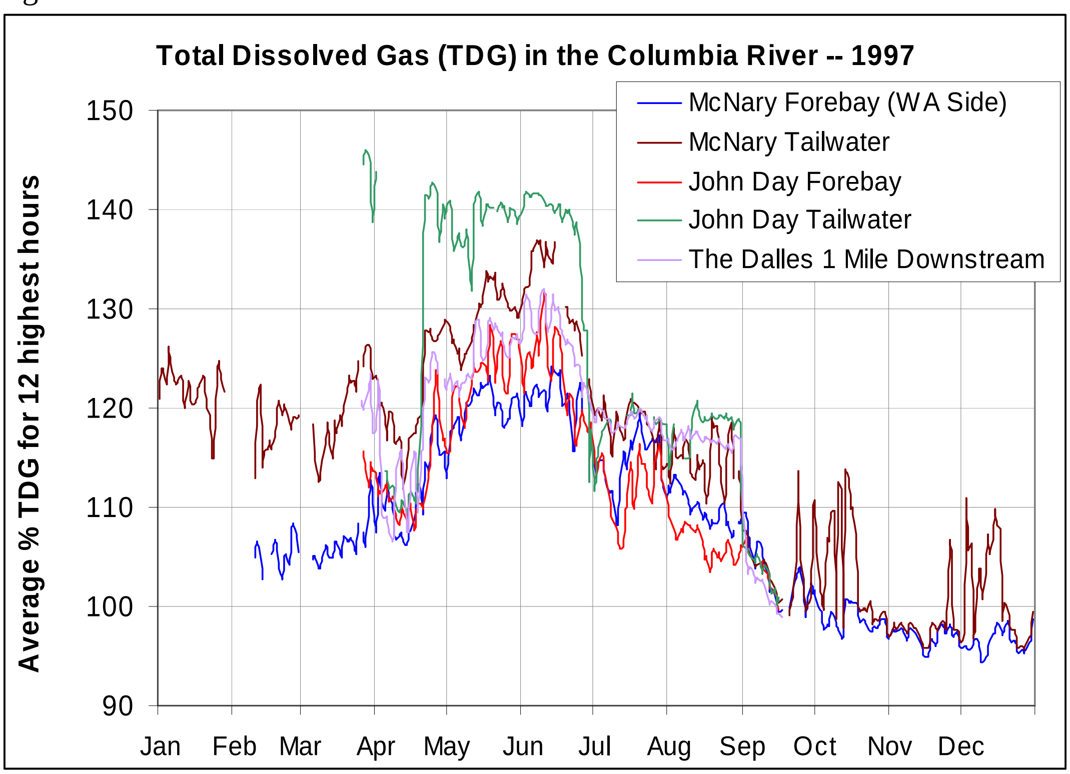


Figure 13. Total Dissolved Gas

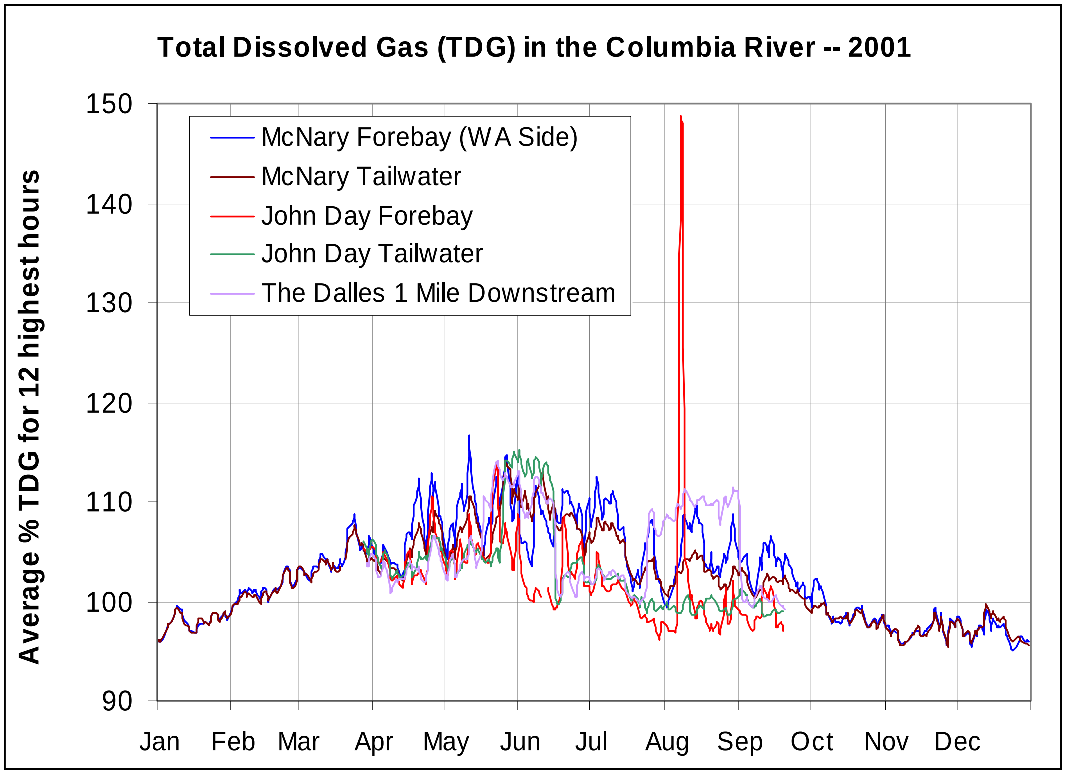
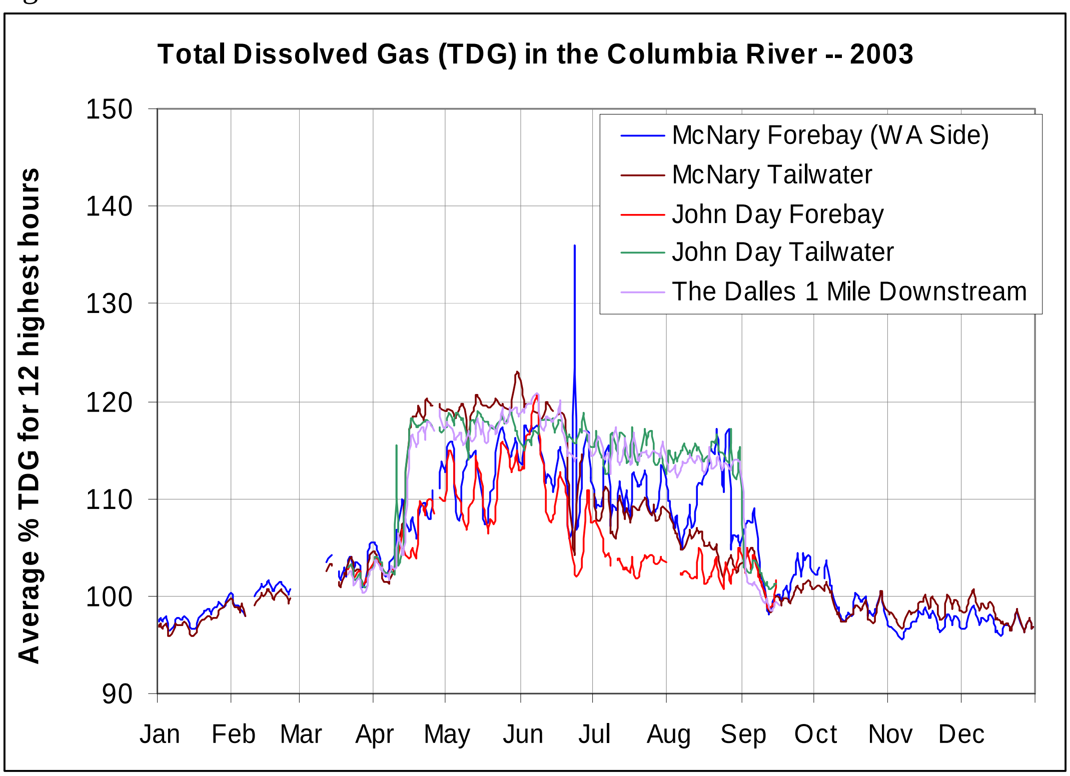


Figure 14. Total Dissolved Gas



Ground Water

Ground Water Occurrence

The state defines ground water as:

> . . . all waters that exist beneath the land surface or beneath the bed of any stream, lake or reservoir, or other body of water within the boundaries of this state, whatever may be the geological formation or structure in which such water stands or flows, percolates or otherwise moves . . . (RCW 90.44.035).

There is a tendency for ground water to be thought as existing in underground lakes or rivers; however, what is referred to as ground water is underground water found in pore spaces between grains of soil or rock or within fractured rock formations (Ecology 1997). Ground water typically originates as precipitation that infiltrates the soil surface and percolates through soil and underlying unsaturated geologic materials to the water table. The water table represents the surface of a saturated zone, a zone in which all voids are filled with water. Water in a saturated zone is referred to as ground water. In cases where a saturated zone is capable of yielding water to a well, the saturated zone is referred to as an aquifer. Saturated zones comprised of coarse sands and gravels or those occupying large fractures in bedrock are generally the most productive aquifers. The process of infiltration and percolation of water to ground water described is known as aquifer recharge.

Surface water bodies and aquifers, particularly shallow aquifers, are often interconnected. Under such conditions, when water in a stream lies above the level of an aquifer, water tends to flow from the stream to the aquifer. Conversely, when water in an aquifer that is adjacent to a stream lies at a level higher than that of the stream, water tends to flows from the aquifer into the stream or "discharge" to the stream. Stream flow during low flow periods that is derived from ground water discharge is referred to as "baseflow." Baseflow is important in maintaining year-round flow in streams fed by runoff from rain and snowmelt (Hermanson 1991).

Aquifers occur as unconfined or confined. The condition described in which a saturated zone is separated from the ground surface by permeable soils and geologic materials is an unconfined aquifer, sometimes referred to as a "water table" aquifer. The water table surface represents the point at which water is at zero hydraulic pressure. Unconfined aquifers are typically shallow, and flow directions within them tend mimic the topography of the overlying land surface (Hermanson 1991).

A confined aquifer is separated from the ground surface and/or an overlying aquifer by a relatively impermeable, non-water bearing zone known as an aquitard. A confined aquifer often overlies other confined aquifers. Confined aquifers receive most of their recharge from areas where the aquitard is absent, or where there are cracks or gaps in the aquitard. Frequently, such recharge areas are in adjacent uplands. Water in a confined aquifer is unable to rise and fall freely because it is bound within its upper and lower confining layers. Thus, water in most confined aquifers is under pressure. When wells are drilled into confined aquifers, water levels in the well rise to a level above the top of the aquifer. Such wells are referred to as artesian.

When pressure is sufficient to cause water in a well to rise above the surrounding ground surface, the well is referred to as flowing artesian. The level to which water in a confined aquifer will rise in a well forms an imaginary surface known as the potentiometric surface. The relationship of the potentiometric surface to a confined aquifer is similar to that of the water table to an unconfined aquifer (Hall and Dight 1987).

A potentiometric surface can fluctuate seasonally and from year-to-year due effects from variability in recharge amounts (seasonal precipitation, drought, etc.). However, where adequate water level monitoring data are available, the potentiometric surface of an aquifer surface can be mapped or modeled demonstrating contours, gradients, and flow direction.

Ground Water Occurrence in Washington State

Ground water aquifers are present throughout the state of Washington. The state's ground waters are used for a variety of purposes including drinking water, irrigation, stock watering, fish propagation, heating and cooling, industrial processes, and surface water augmentation.

Hermanson (1991) recognized a number of different types or classes of aquifers that are common within Washington. The Columbia River basalt aquifer occupies fractures in lava flows of the Columbia basin and beds of sand and gravel sandwiched between the flows. Because of variability in the nature of aquifer materials, yields from wells tapping this aquifer extend over a wide range; however some wells produce between 3,000 and 6,000 gallons per minute and are suitable for use by large irrigation systems and public water systems.

Glacial drift type aquifers are common in the northern parts of eastern Washington as well as most of the Spokane Valley. These aquifers mainly occupy outwash deposits (meltwater sand and gravel deposits) left by advancing or receding glaciers. Wells completed in glacial drift aquifers typically produce less than 700 gallons per minute; however, some wells produce significantly higher yields. Water from wells completed in this aquifer is primarily used for public water supply and for single domestic purposes.

Valley-fill and alluvial types of aquifers occur in river valleys, river terraces, and deltas in various parts of the state. Well yields range from a few gallons per minute to several thousand gallons per minute. Water from wells completed in this aquifer is also primarily used for public water supply and for single domestic purposes.

Ground Water Quality

The Department of Ecology's 2001 Water Quality Assessment, an update to the 2000 Clean Water Act Section 305(b) Report, concluded that generally, ground water quality in Washington State is "good." However, the document noted that there are several areas of degraded ground water quality where beneficial uses have been adversely affected. The assessment attributed the ground water quality problems primarily to nitrates, pesticides, metals, and other types of nonpoint pollution. Nonpoint pollution is created by diffuse land and water use activities such as use of on-site sewage disposal systems, commercial and non-commercial use of pesticides and fertilizer, and management of stormwater runoff.

Plants

Plants are listed by the federal government as either threatened or endangered species in Washington State are shown in Figure 15.

Figure 15 – Listed Plants in Washington

Listing	Status
Sandwort, Marsh (*Arenaria paludicola*)	Endangered
Paintbrush, golden (*Castilleja levisecta*)	Threatened
Stickseed, showy (*Hackelia venusta*)	Endangered
Howellia, water (*Howellia aquatilis*)	Threatened
Desert-parsley, Bradshaw's (*Lomatium bradshawii*)	Endangered
Lupine, Kincaid's (*Lupinus sulphureus (=oreganus) ssp. Kincaidii (=var. kincaidii*))	Threatened
Checker-mallow, Nelson's (*Sidalcea nelsoniana*)	Threatened
Checkermallow, Wenatchee Mountains (*Sidalcea oregana var. calva*)	Endangered
Catchfly, Spalding's (*Silene spaldingii*)	Threatened
Ladies'-tresses, Ute (*Spiranthes diluvialis*)	Threatened

General Description

The east slopes of the Cascade Range are covered by coniferous forests consisting of a mixture of Douglas fir, white pine, and in places western larch. This type of forest also occupies the northern border of the state extending to the Idaho border. In an easterly direction from the Cascade Range and in a southerly direction from the northern border, the forest quickly transitions to extensive ponderosa pine forests with sparse shrub understories. The central portion of eastern Washington, including the Columbia Plateau, is a shrub-steppe environment dominated by sagebrush and short grasses. The southeast portion of eastern Washington, the Palouse Hills, consists of a prairie occupied by tall grasses. The Blue Mountains in the southeast show vegetation trends with elevation that are similar to the east slopes of the Cascade Range.

Riparian Habitat

Throughout the state, riparian habitat occurs in areas adjacent to rivers, streams, seeps, and springs. Because it typically occurs in narrow bands, riparian habitat occupies a relatively small percentage of the state’s land area. However, because riparian habitat occurs as a transitional zone between aquatic and upland habitats, it serves as a critical component of the state’s flora and fauna. Eighty-two species of fish may be found in Washington’s freshwater bodies at some point in their life cycles (WDFW 1997). Suitable riparian habitat is extremely important to a wide variety of wildlife species, including both vertebrates and invertebrates. Riparian vegetation and habitat condition interacts with water to affect both aquatic habitat and riparian habitat in complex ways (see references, discussions, and illustrations in Annear, et al., 2004).

Wetland Habitat

Wetlands are defined as:

> Those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (Ecology 1996).

Washington State has a wide variety of wetlands, ranging from the estuarine salt marshes of the Columbia River estuary and the Pacific Coast, to riparian wetlands adjacent to rivers streams as an integral part of riparian habitat, to potholes and vernal pools of eastern Washington, and to high elevation meadows and fens. The climate of eastern Washington gives rise to a variety of permanent and intermittent wetlands that are typically very different from western Washington wetlands in their seasonality, chemistry, and plant species distribution (Ecology 1993).

Wetlands are capable of performing a number of functions, including many that are similar to those described for riparian areas, such as:

- Ground water recharge and discharge;
- Stormwater and floodwater detention;
- Water quality improvement;
- Erosion control and buffering;
- Food chain support; and
- Wildlife habitat and corridors (Ecology 1998).

Many of Washington's wetlands have been lost since the early 1900s due to various types of development activities (e.g., urban development, utility infrastructure construction, logging, and agriculture). Many of the remaining wetlands in the state have been degraded through alteration of hydrology, sedimentation, removal of vegetation (Ecology 1993).

Contrary to the trend, many wetlands were created by the completion of the Columbia Basin Project where the groundwater balance has been affected by the large scale import of water from the river.

Fish and Wildlife

Animals listed by the federal government as either threatened or endangered species in Washington State are listed in Figure 16. A list of species of concern as determined by Washington State is available at http://wdfw.wa.gov/wlm/diversty/soc/soc.htm.

Figure 16. Listed Animals in Washington

Listing	Status
Salmon, chinook (spring upper Columbia R.) (*Oncorhynchus (=Salmo) tshawytscha*)	Endangered
Salmon, chinook (Puget Sound) (*Oncorhynchus (=Salmo) tshawytscha*)	Threatened
Salmon, chinook (fall Snake R.) (*Oncorhynchus (=Salmo) tshawytscha*)	Threatened
Salmon, chinook (lower Columbia R.) (*Oncorhynchus (=Salmo) tshawytscha*)	Threatened
Salmon, chinook (spring/summer Snake R.) (*Oncorhynchus (=Salmo) tshawytscha*)	Threatened
Salmon, chum (Columbia R.) (*Oncorhynchus (=Salmo) keta*)	Threatened
Salmon, chum (summer-run Hood Canal) (*Oncorhynchus (=Salmo) keta*)	Threatened
Salmon, sockeye U.S.A. (Snake River, ID stock wherever found.) *(Oncorhynchus (=Salmo) nerka)*	Endangered
Salmon, sockeye U.S.A. (*Ozette Lake, WA) (Oncorhynchus (=Salmo) nerka*)	Threatened
Steelhead (upper Columbia R. Basin) (*Oncorhynchus (=Salmo) mykiss*)	Endangered
Steelhead (Snake R. Basin) (*Oncorhynchus (=Salmo) mykiss*)	Threatened
Steelhead (upper Willamette R.) (*Oncorhynchus (=Salmo) mykiss*)	Threatened
Steelhead (lower Columbia R.) (*Oncorhynchus (=Salmo) mykiss*)	Threatened
Trout, bull (U.S.A., conterminous, lower 48 states) (*Salvelinus confluentus*)	Threatened
Albatross, short-tailed (*Phoebastria (=Diomedea) albatrus*)	Endangered
Bear, grizzly lower 48 States, except where listed as an experimental population (*Ursus arctos horribilis*)	Threatened
Butterfly, Oregon silverspot (*Speyeria zerene hippolyta*)	Threatened
Caribou, woodland (ID, WA, B.C.) (*Rangifer tarandus caribou*)	Endangered
Deer, Columbian white-tailed Columbia River DPS (*Odocoileus virginianus leucurus*)	Endangered
Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)	Threatened
Lynx, Canada (*Lynx canadensis*)	Threatened
Murrelet, marbled (CA, OR, WA) (*Brachyramphus marmoratus marmoratus*)	Threatened
Owl, northern spotted (*Strix occidentalis caurina*)	Threatened
Pelican, brown (except U.S. Atlantic coast, FL, AL) (*Pelecanus occidentalis*)	Endangered
Plover, western snowy (Pacific coastal pop.) (*Charadrius alexandrinus nivosus*)	Threatened
Rabbit, pygmy Columbia Basin DPS (*Brachylagus idahoensis*)	Endangered
Sea turtle, green (except where endangered) (*Chelonia mydas*)	Threatened
Sea turtle, leatherback (*Dermochelys coriacea*)	Endangered
Sea-lion, Steller (eastern pop.) (*Eumetopias jubatus*)	Threatened
Whale, humpback (*Megaptera novaeangliae*)	Endangered
Wolf, gray Western Distinct Population Segment (*Canis lupus*)	Threatened

General Description

The wildlife of Washington State is quite diverse. This diversity of species inhabit an equally diverse variety of habitat types ranging from desert to rainforest in the terrestrial environment, and mountain spring to ocean in the aquatic environment. The variety of vertebrate (fish, amphibian, reptile, bird, and mammal) and invertebrate (mollusk, arthropod, and echinoderm) life in Washington State prohibits an exhaustive listing of species and habitats. However, this document references the following categories of wildlife based on the Washington Department of Fish and Wildlife's Priority Habitat and Species (PHS) program. Examples of animals in each category are provided in parentheses.

Invertebrate

There are no priority species of arthropods (e.g. crustaceans/crab) in the project area. There are no priority species of echinoderms (urchin) in the project area. Insects include the Columbia River Tiger Beetle, a species of concern and candidate species in the State of Washington.

Mollusks include the priority species of gastropods (Giant Columbia River limpet, Great Columbia River spire snail), and bivalves (California floater). All three of these species are State candidate species. The Great Columbia River spire snail (a.k.a. Columbia Pebblesnail) and the California floater are also Federal Species of Concern.

"State Candidate Species include fish and wildlife species that the Department of Fish and wildlife will review for possible listing as State Endangered, Threatened, or Sensitive. A species will be considered for designation as a State Candidate if sufficient evidence suggests that its status may meet the listing criteria defined for State Endangered, Threatened, or Sensitive." (WDFW Policy M-6001)

Vertebrate

Large mammals include priority species categories of big game ungulates (elk), and terrestrial carnivores (fisher). Several large mammals (e.g., black bear, raccoon, river otter, and mink) feed opportunistically on fish.

Small mammals include priority species categories of shrews (Merriam's shrew), bats (Big brown bat), rabbits (Black-tailed jack rabbit), and rodents (Washington ground squirrel).

Birds include the priority species categories of marine birds (American white pelican); herons (Black-crowned night heron); waterfowl (Aleutian Canada goose); hawks, falcons, eagles (Bald eagle); upland game birds (Blue grouse); cranes (Sandhill Crane); shorebirds (Phalaropes); pigeons (Band-tailed pigeon); cuckoos (Yellow-billed cuckoo); owls (Burrowing owl); swifts (Vaux's swift); woodpeckers (Black-backed woodpecker); and perching birds (Loggerhead shrike). Several fish-eating birds have increased in abundance in the Columbia River corridor in response to vulnerable concentrations and conditions favorable to capture of fish; these include double-crested cormorant and Caspian tern. Other fish-eating birds (e.g., belted kingfisher, great blue heron) have not had as clear a response to fish conditions.

Reptiles include the priority species categories of snakes (California mountain king snake), turtles (Western pond turtle), and lizards (Western skink).

Amphibians include the priority species categories of frogs (Columbia spotted frog) and salamanders (Cascades torrent salamander).

Fish include the priority species categories of lamprey (River lamprey); sturgeon (Green sturgeon); minnows (Lake chub); suckers (Mountain sucker); catfish (Channel catfish); smelt (Eulachon); trout, salmon, and whitefish (Bull trout); sculpins (Margined sculpin); sunfish (Largemouth bass); perches (Walleye) (WDFW 1999). The list of fish enumerated above includes both native and non-native as well as freshwater and marine water species.

Fish habitat and fish recovery, especially for fish in the salmon family (salmonids), are critical components of large-scale water resource management efforts and will be addressed in more detail below. For purposes of this document, the term "salmonid" applies to trout, char, and salmon consistent with the Governor's *Statewide Strategy to Recovery Salmon – Extinction is not an Option* (WSJNRC 1999). The following discussion is segregated into 1) salmonids and 2) other (non-salmonid) fish.

Resident Salmonids

Resident salmonids remain in freshwater habitat for their entire life cycle. All resident salmonids require clean, cool water to thrive. As will be noted below, some populations of resident salmonids in Washington State are declining. Such declines can be attributed to a number of factors including loss of suitable rearing habitat, water quality degradation, and loss of clean spawning gravels.

Resident salmonids typically feed on plankton, insects, other invertebrates, and smaller fish. Some of the most important and widespread native species of resident salmonids are rainbow trout, cutthroat trout, and bull trout. These species are discussed in more detail below. In addition to those species discussed below, there are a number of introduced (non-native) resident salmonid species in Washington's lakes and streams including brown trout, golden trout, lake trout, and eastern brook trout.

***Rainbow Trout* –** Rainbow trout are widely distributed in Washington's lakes and streams and are the state's most popular game fish. Because of their popularity, natural populations are supplemented by Washington Department of Fish and Wildlife stocking programs that add over 17 million rainbow trout each year to the state's lakes and streams. Resident rainbow trout generally grow to a length of 18-24 inches. Rainbow trout include the sub-species of concern known as the red-band trout that is native to Washington State and other parts of the Columbia River basin.

***Cutthroat Trout* –** Resident coastal cutthroat trout are found in streams and ponds throughout much of western Washington. Although they may grow to a length of about 18 inches, in smaller bodies of water they may grow no larger than eight or nine inches. One group, or what is referred to as an "Evolutionary Significant Unit (ESU)," of coastal cutthroat trout, the Southwestern Washington/Columbia River ESU, has been proposed by U.S. Fish and Wildlife Service to be listed as a threatened species under the federal Endangered Species Act. West-slope cutthroat trout, another subspecies of cutthroat trout, are more common in eastern Washington lakes and streams and are planted by Washington Department of Fish and Wildlife in a number high-country lakes. Native populations of west-slope cutthroat trout also exist in eastern Washington lakes and streams.

***Bull Trout* –** Although commonly called trout, bull trout are actually members of the char subgroup of the salmon family. Scientists distinguish char from other salmonids (trout and salmon) by the absence of teeth in the roof of the mouth and the presence of light colored spots on a dark background (trout and salmon have dark spots on a lighter background. Bull trout living in streams may grow to about four pounds while those living in lakes reach a weight of 20 pounds. Some bull trout live out their lives in areas near where they were hatched, while others migrate from streams to lakes, reservoirs, or salt water bodies a few weeks after emerging from their nests. While bull trout are known to live as long as twelve years, they reach sexual maturity between four and seven years of age. They spawn in gentle stream reaches with cold, unpolluted water and gravel and cobble substrate. Spawning occurs in the fall after stream temperatures have dropped to a satisfactory level.

The Columbia River bull trout distinct population segments have been listed as threatened under the federal Endangered Species Act. The designated boundary for this distinct population segments encompass the entirety of the Columbia River basin within the state of Washington; however, the U.S. Fish and Wildlife Service is still in the process of designating critical habitat (USFWS 1998; USFWS 2003). The U.S. Fish and Wildlife Service has proposed critical habitat for the Columbia River distinct population segment including portions of the Pend Oreille, Methow, Entiat, Wenatchee, Upper Yakima, Naches, Lower Yakima, Middle Snake, Walla Walla, Klickitat, Wind/White Salmon, and Lewis WRIAs (USFWS 2003). The critical habitat designation for the Columbia River distinct population segment is scheduled to take effect in October 2003. In addition, Ecology has proposed amendments to the state's surface water quality standards (Chapter 173-201A WAC) that would designate specific waters of the state as native char habitat for purposes of applying a protective temperature water quality criterion (Ecology 2003).

***Mountain whitefish* –** Mountain whitefish are in a separate subfamily of Salmonidae and may be the most numerous salmonid in Washington. They are resident in large and medium-sized rivers, where they inhabit deep pools with strong current.

Anadromous Salmonids

Fish that hatch and rear in freshwater, spend a portion of their life in salt water, and then return to freshwater to spawn are referred to as anadromous species. Washington has seven native species of anadromous fish belonging to the genus Oncorhynchus. These species can collectively be called salmon and include: Chinook, coho, chum, and sockeye salmon; steelhead;

and sea-run coastal cutthroat trout. In addition, Washington also has a native anadromous species belonging to the genus Salvelinus, bull trout.

Salmon habitat extends from the smallest inland streams to the Pacific Ocean, and is comprised of a vast network of freshwater, estuarine, and ocean habitats. Freshwater habitats are used by salmon for spawning, incubation, and juvenile rearing. In estuarine habitats, juvenile salmon experience rapid growth and make critical adjustments in the chemical balance of their body fluid as they transition between fresh and salt water. Salmon gain most of their adult body mass in ocean habitats before returning to rivers to spawn (WDFW 2000-2001).

Throughout their lives, salmon feed on a variety of freshwater and marine invertebrate organisms and fishes, while being fed upon by a variety of parasites, predators, and scavengers. Juvenile salmon feed on salmon carcasses, eggs, and invertebrates, including invertebrates that may have previously fed on salmon carcasses such as caddis, stoneflies, and midges. Thus, returning salmon provide a flow of nutrients into freshwater habitats and play a critical role in the ability of watersheds to retain overall productivity of salmon runs (WDFW 2000-2001).

Due to over-fishing, habitat loss, the effects of hydropower facilities, hatchery problems, and a changing ocean environment, salmon populations have declined significantly over the past several decades. Many salmon stocks in Washington State are now listed by National Oceanic and Atmospheric Administration (NOAA) Fisheries as either threatened or endangered under the federal Endangered Species Act (WDFW 2000-2001).

***Chinook Salmon* –** Chinook salmon are the largest of all salmon. There are different seasonal "runs" or modes in the migration in the migration of Chinook salmon from the ocean to freshwater. These runs are usually identified as spring, summer, fall, or winter based on when the adult salmon enter freshwater to begin their spawning migration, but winter runs are restricted to California. Freshwater entry and spawning are believed to be related to local water temperature and water flow regimes. An adult female Chinook will prepare a spawning bed, called a redd, in a stream area with suitable gravel composition, water depth, and velocity. An adult female may deposit four to five "nesting pockets" within a single redd. Chinook salmon eggs will hatch 90 to 150 days after deposition and fertilization. Juvenile Chinook may spend from three months to two years in freshwater before migrating to estuarine waters as smolts. After a period of rapid growth, they migrate to the ocean, feed and mature. Chinook remain in the ocean for one to six years, most commonly two to four. Chinook salmon are the largest of the Pacific salmon, typically about 40 pounds; although those with long ocean residence time can sometimes grow to over 100 pounds.

A number of distinctive groups in the Columbia River basin or what are termed "Evolutionary Significant Units" (ESUs) of Chinook salmon are listed endangered or threatened under the federal Endangered Species Act including the Snake River Fall-run (threatened), Snake River Spring/Summer-run (threatened), Lower Columbia River Chinook (threatened), and Upper-Columbia River Spring-run (endangered) ESUs (NOAA Fisheries 2000). In addition, the Snake River Fall-run, Snake River Spring/Summer-run, Lower Columbia River Chinook, and Upper-Columbia River Spring-run of Chinook salmon have been designated by the Washington Department of Fish and Wildlife as "State Candidate Species" (WDFW 1999).

***Coho Salmon* –** Coho salmon spend approximately half their life cycle rearing in streams and tributaries. The long freshwater rearing period makes coho salmon more dependent on flow and freshwater habitat than salmonids with shorter freshwater rearing times. The remainder of their life cycle up to the point of returning to their stream of origin to spawn and die is spent foraging in estuarine and marine waters of the Pacific Ocean. Most adults return as three year olds; however, small number return after two. A mature coho is usually about two feet in length and weighs an average of about eight pounds. In the Columbia River basin, one "Evolutionary Significant Units" (ESUs) of coho salmon are listed as a candidate species under the federal Endangered Species Act: the Lower Columbia River/Southwest Washington ESUs (NOAA Fisheries 2000a).

***Chum Salmon* –** Chum salmon are large salmon, second only to Chinook salmon in size. They spawn in the lower reaches of rivers and creeks, typically within 60 miles of the Pacific Ocean. They migrate almost immediately after hatching to estuarine and ocean habitats; thus, survival and growth of juvenile chum depends less on freshwater habitat conditions than on estuarine and marine habitat conditions. They usually arrive at their stream of origin from November to the end of December. Most chum salmon mature in between three to five years. The weight of a mature chum salmon is between 18 to 22 pounds. The Columbia River basin one "Evolutionary Significant Units" (ESUs) of chum salmon is listed as threatened species under the federal Endangered Species Act: the (lower) Columbia River ESUs (NOAA Fisheries 2000b).

***Sockeye Salmon* –** Sockeye salmon exhibit a variety of life history patterns that reflect varying dependency on freshwater environments. Most Sockeye salmon spawn in or near lakes where juveniles rear for one to three years before migrating to the ocean. For this reason, the major distribution and abundance of this salmon species is closely related to the location of rivers that have accessible lakes in their watersheds, such as the Wenatchee River (Lake Wenatchee).

There are also non-anadromous forms of sockeye salmon that spend their entire life in fresh water. Occasionally, a portion of the juveniles in an anadromous population will remain in their rearing lake environment throughout their lives and will eventually spawn together with their anadromous siblings. In Washington State, non-anadromous sockeye are referred to as kokanee.

One distinctive group or what is termed an "Evolutionary Significant Unit" (ESU) of sockeye salmon is listed as an endangered species under the federal Endangered Species Act, the Snake River ESU (NOAA Fisheries 2000c).

***Steelhead* –** Steelhead are sea-going rainbow trout. They begin their lives in freshwater rivers and creeks where they rear for two years before migrating to marine waters. Consequently, they are very dependent on flows and freshwater habitat. They reside in marine waters for one to six years (typically two to three years), then return to their home streams to spawn. Unlike salmon, which die after their spawning runs, adult steelhead can return to the sea and repeat the cycle. Adult steelhead typically range from 5 to 14 pounds; although, those with long ocean residence time may reach about 30 pounds.

Most steelhead spawn from mid-winter to late-spring; however, two distinct “runs” of steelhead return to freshwater at different times, a winter run and a summer run. Winter-run steelhead return to over 100 streams throughout Washington State from November to the end of April. Washington Department of Fish and Wildlife plants hatchery winter run-steelhead in about 75 streams to enhance fish populations. Summer-run steelhead return to freshwater from April to the end of September in about 36 Washington rivers and creeks. Summer-run hatchery stocks are planted in approximately 45 rivers and creeks by the Washington Department of Fish and Wildlife (WDFW 2001).

Wild steelhead runs have been depleted in a number of river systems because of habitat loss and other problems (WDFW 2001). A number of distinctive groups or what are termed “Evolutionary Significant Units” (ESUs) of steelhead are listed endangered or threatened under the federal Endangered Species Act including the Middle Columbia River (threatened), Snake River Basin (threatened), Lower Columbia River (threatened), and Upper Columbia River (endangered) (NOAA Fisheries 2000d).

Sea-Run Cutthroat Trout – Sea-run cutthroat trout are the anadromous population of the coastal cutthroat trout. Like steelhead, sea-run cutthroat trout rear for two years in freshwater before migrating and, thus, are very dependent on flow and freshwater habitat. They spawn in coastal, Puget Sound, and lower Columbia River tributary streams. The Southwestern Washington/Columbia River “Evolutionary Significant Unit” of coastal cutthroat trout has been proposed by the U.S. Fish and Wildlife Service to be listed as a threatened species under the federal Endangered Species Act.

Bull Trout – As previously discussed, some portions of bull trout populations will migrate from freshwater to marine waters after rearing and will return to freshwater to spawn. Those portions of bull trout populations are considered anadromous.

Other Fish

The discussion of “other fish” is comprised of two subsections: freshwater fish and anadromous fish. It is recognized that some of the fish described below live at least a portion of their lives in estuaries or tidal affected portions of rivers that are transitional areas between freshwater and marine waters.

Freshwater Species

Approximately 70 non-salmonid fish species can be found in freshwater bodies of Washington State at some point in their life cycles. Of this number, over 30 species are introduced including some of the more popular sport fish such as: largemouth bass, smallmouth bass, walleye, crappie, yellow perch, catfish, tiger muskie, and bluegill sunfish. Native freshwater species include sturgeon, the largest freshwater fish species; a variety of minnows such as northern squawfish, northern pikeminnow, redside shiner, leopard dace, and speckled dace; burbot (a member of the cod family); largescale sucker; sandroller; Columbia River smelt (eulachon), and a number of sculpin species (WDFW 1997; WDFW 2001).

A number of the fish species identified above have been identified as State Candidate Species or Species of Concern by Washington Department of Fish and Wildlife for some Washington waters including the Leopard dace and Columbia River smelt.

Anadromous Species

Native and non-native species, such as white sturgeon, Pacific lamprey, and American Shad are anadromous species using portions of the Columbia River basin.

Native Shellfish

Shellfish (mollusks) such as the Giant Columbia River limpet (shortface lanx), the Great Columbia River spire snail (Columbia pebblesnail), and the California floater were once common throughout the Columbia River basin. All three species require cold, clear water habitats. The shortface lanx prefers high velocity portions of the system, whereas the California floater prefers lower gradient areas with soft, silty substrate.

Human alteration of the Columbia River system (e.g. hydroelectric development) has significantly limited the distribution and abundance of all three species. Presently, all three mollusk species are Washington State "candidate" species.

Scenic Resources and Aesthetics

As noted above in land use, the State of Washington hosts a wide variety of land uses. Parts of the state have been developed for urban and suburban land uses including combinations of residential, commercial, industrial, and institutional land uses and associated infrastructure such as roads, power facilities, water facilities, and wastewater treatment plants. Some rural portions of the state have been intensely developed for agriculture, forestry, and mineral extraction. These areas may also have sporadic low density residential development. Other rural areas and natural areas are largely undeveloped, or developed almost exclusively for outdoor recreation. Most local governments have some form of land use plan and/or zoning code or ordinance that seeks to ensure that aesthetics are considered when permitting for development occurs.

The state's wide variety of natural settings and climate provides abundant scenic resources. Among these scenic resources are extensive coastal and estuarine waters and associated islands and beaches, and numerous mountain ranges, rivers, lakes, and wetlands. The Interagency Committee for Outdoor Recreation estimates that 50% of the approximately 587,000 people who partake in sightseeing activities each year in Washington State do so at scenic areas (Interagency Committee for Outdoor Recreation 2002).

Land and Shoreline Use

Land use in Washington State is highly diverse. Portions of the Cascade Range are dedicated to federally owned wilderness areas, national parks, national recreation areas, and national forests. The national forests are managed for multiple uses including commercial timber production and recreation. Private forest lands are also common in these mountainous areas as well as in northeast Washington.

Areas around Spokane, Richland, Kennewick, Pasco, Yakima, and Wenatchee in eastern Washington are characterized by urban levels of development. These urbanized areas are host to much of the state's population, as well as its manufacturing, commercial, and service industry base.

The Columbia River basin is also the site of extensive agricultural development. Major portions of Eastern Washington have been developed for agricultural production. The Yakima, Wenatchee, and Okanogan River Valleys are host to large scale irrigated agriculture, as is the Columbia Basin in the central part of eastern Washington. Southeast Washington is extensively developed for dry-land farming of primarily wheat.

Counties and cities that have experienced significant growth over the last several decades are required to prepare comprehensive plans under the state's Growth Management Act (Chapter 36.70A RCW). That act requires affected cities and counties to designate their rural areas and urban growth areas and to conduct capital facilities planning to ensure that adequate public facilities are provided concurrent with future growth within designated urban growth areas. The Growth Management Act also requires all counties and cities to develop and adopt development regulations to protect critical areas such as wetlands, fish and wildlife habitat, and aquifer recharge areas. Development within shoreline areas is governed under shoreline master programs adopted pursuant to the state's Shorelines Management Act (Chapter 90.58 RCW). Local master programs, which must be approved by Ecology, are intended to protect shorelines from development and to require mitigation of impacts where appropriate.

Cultural Resources

Cultural resources consist of archeological, historic, and traditional cultural places including buildings, structures, sites, districts, objects, and landscapes. The State Office of Archeology and Historic Preservation has records of over 20,000 archeological and traditional cultural places and over 100,000 historic properties within the state. This information is maintained in the Washington State Inventory of Cultural Resources (OAHP 2002).

Under the State Environmental Policy Act, potential significant adverse impacts to historic, archeological, and traditional cultural places associated with project actions must be identified and evaluated. The Office of Archeology and Historic Preservation is the agency responsible for providing formal opinions to local governments and other state agencies on a site or property's significance and the potential impact of a proposed project action upon such sites or properties.

Similarly, the National Historic Preservation Act requires that all federal agencies consider cultural resources as part of all licensing, permitting, and funding decisions (OCD 2002).

While legally not considered historic, archeological, and traditional cultural places, many of the state's rivers and other surface water bodies have cultural significance to some population groups, including many Native American tribes. Rivers and their tributaries can be viewed as being analogous to the bloodstream of a watershed and have great importance on both a practical and spiritual level.

Recreation

Waters of the State of Washington are used extensively for recreation. Citizens of the state, as well as visitors to the state, enjoy sightseeing, aquatic waterfowl watching, hunting, fishing, and other water oriented activities. Water activities include a variety of different pursuits including swimming or wading, motor boating, water skiing, personal water craft use (e.g., jet skis), sail boating, hand power boating (kayaking, canoeing, or rowing), white water rafting, inner tubing, wind surfing, surfboarding, scuba diving, and beachcombing.

In many cases, the types of recreational opportunities afforded are determined by the nature of the water body. For example, white water rafting requires free flowing rivers with adequate flows to create whitewater conditions. Conversely, lakes and reservoirs are generally more conducive to power boating and wind surfing than free flowing streams. If the character of a water body is changed through flow alterations, such as construction of a dam, associated recreational opportunities may change as well. Similarly, if the quality of water in a lake or stream changes, it may alter the use of the water body for recreation. For example, bacterial or chemical contamination in a water body may make it unsuitable for swimming or fishing. An increase in water temperature in a lake may alter fish populations, potentially reducing the numbers or eliminating cold water fish species (e.g., some types of trout) and creating conditions more conducive for warm water fish species (e.g., bass).

Transportation

The public highway and road network in Washington State is comprised of approximately 81,300 miles (130,840 kilometers) of federal, state, and local roads. Included in that number are 757 miles (1,218 kilometers) of interstate highways (Access Washington 1998-2002).

Washington State is served by a number of private railroads, including two large Class I railroads: the Burlington Northern Santa Fe Railway and the Union Pacific Railroad. In total, there are about 3,470 miles (5,585 kilometers) of Class I railroad track in Washington (Access Washington 1998-2002).

Washington has a number of large ports that are important hubs for transpacific shipping including Kalama and Longview on the Columbia River. The Columbia River and Snake River are conduits for barge traffic.

Public Services and Utilities

There are 11 dams on the Columbia River in Washington and 55 major hydroelectric projects located on the Columbia River and its tributaries. One of the principal tasks of these dams is power generation. About 60% of the region's electricity comes from hydropower. (http://www.bpa.gov/Power/pl/columbia/).

Significant Impacts

In this section the potentially significant impacts resulting from each of the alternatives, no action and preferred, are presented and analyzed.

Because the Draft Environmental Impact Statement is programmatic in nature it analyzes the probable effects of the proposed rule itself. However, it should be understood that implementation of the water resources management program for the Columbia River over a period of 20 years will require that additional actions or projects are implemented to provide access to mitigation water. These projects, frequently developed in partnership with non-state entities, in most cases will require the development of analyses determining the probable costs and benefits, and environmental consequences resulting from their completion. As a result, this DEIS does not attempt to describe the effects of any project-specific action that is proposed to implement the preferred alternative.

No Action Alternative

IMPACTS ON THE BUILT ENVIRONMENT

The current environment is characterized by uncertainty at several levels. The lack of mitigation standards increases transaction costs, as well as mitigation costs, for water right applicants. Litigation uncertainty raises serious questions over the nature of rights that might be secured at the conclusion of legal proceedings. In each case, uncertainty directly constrains private and public decision-making in the region.

A primary responsibility for local governments is planning for the delivery of reliable public services. Water for drinking and industrial uses is a critical component of public infrastructure. Currently, municipal planning for the delivery of water to meet future demand is clouded. The lack of clear standards for mitigation for water withdrawals creates a situation in which decision-makers cannot assess future costs. In addition, the costs of acquiring mitigation in a piecemeal fashion may be higher than they would be under a program that is planned and implemented on a large scale over a period of years.

The likelihood of exposure to litigation limits a jurisdiction’s ability to make reasonable assumptions about access to water. The depth of the uncertainty has effectively closed the river to new appropriations.

For those applicants that pursue state action, high transaction costs can be expected as a result of both time delays inherent in the consultation process and the need to develop unique mitigation packages for each application that is considered. These costs represent a significant barrier to smaller operations, and, cumulatively, result in forgone economic opportunities in the state.

IMPACTS ON THE NATURAL ENVIRONMENT

While the existing regulatory framework, from a purely pragmatic perspective, is not likely to result in a significant quantity of new water use from the Columbia River for several years, there are environmental impacts that can be expected to affect the ecosystem eventually and therefore must be considered. Lacking a comprehensive strategy to reduce them, current levels of risk to salmon and other aquatic species are likely to further increase in the years ahead. Without an agreed upon mitigation standard, the likelihood of projects that reduce flows in the river is greater. Land use changes would occur as dry land agricultural practices shift to higher value-added irrigated crops. Air quality would be incrementally affected as economic and population growth occurs. Conversely, the number of projects that are approved under the existing rule is likely to be smaller than the approvals that would occur under the preferred alternative.

- **Risks Outside the State's Control**

The study conducted by the National Academy of Sciences concluded that the Columbia River ecosystem will be under increasing pressure in the years to come. Decreasing summer stream flows resulting from withdrawals by other jurisdictions and increasing water temperatures due to global warming and decreased stream flows were among the factors cited by the Academy. The state's existing administrative framework does nothing to reduce these risks in the years ahead and additional water used under state permits could exacerbate these problems.

- **Effectiveness of Mitigation Strategies**

In addition, there is mounting skepticism in the scientific community regarding the effectiveness of mitigation strategies that do not result in on-site and in-kind mitigation. The Academy referred to this lack of confidence in their report to the state, as have other groups, including a recent review of wetland mitigation strategies. Under the existing framework it is likely that new permits issued by the state would rely, in whole or in part, on off-site and out-of-kind mitigation strategies. As a result, permit decisions made under the existing rule may have unanticipated or unmitigated environmental effects, including reductions in streamflows.

- **Potential Effects on Streamflows**

The lack of consistently applied mitigation standards may also have a direct effect on streamflows. Current state and local government watershed planning and salmon recovery efforts have employed a variety of out-of-kind mitigation and enhancement strategies designed to protect or improve the survival of endangered species. Mitigation for project specific impacts has included barrier removal, and habitat acquisition and restoration, among other types of actions. These strategies have demonstrated benefits for the target populations. However, in the regard to the mainstem of the Columbia River, these strategies would incrementally reduce streamflows over time as water rights are allocated. This result would be contrary to the advice of the National Academy of Sciences.

- **Land Use Changes**

Land use changes are also worthy of note, although likely to be significantly smaller and delayed in comparison to the preferred alternative. Additional lands currently in agricultural or other open space uses are likely to be converted to municipal or industrial uses as economic and population grow occurs. In addition, the evaluation of agricultural economics commissioned by the state indicates that agricultural lands that are currently dry would be converted to irrigation to generate higher returns to their owners.

- **Air Quality**

Air quality would be expected to incrementally decline as growth and development occur in urban areas. It is unlikely that conversion of agricultural lands from dry land to irrigated practices would significantly affect air quality.

- **Reduced Water Allocations Relative to Preferred Alternative**

Lastly, in comparison to the preferred alternative, the no action alternative is likely to allocate much less water for out-of-stream use than the preferred alternative, particularly in the near term. One result, mentioned above, is a reduced impact on land as a result on economic and population growth and the reduced land use and air quality impacts that would result. In the longer run, assuming current legal barriers to state administration are resolved, each of the categories of environmental impacts discussed above would begin to accrue.

Preferred Alternative

IMPACTS ON THE BUILT ENVIRONMENT

The effects of the preferred alternative will be seen most clearly in the built environment. Impacts will accrue from increased economic activity and employment that emerge as a result of water allocations to private and municipal permittees.

Improved certainty regarding access to reliable water supplies gives local governments the ability to plan for the needs of an increasing population. In addition, access to water supplies is likely to result in greater success in attracting and retaining businesses in the Basin. Increasing population and business development will result in higher demands on public services and utilities. Transactions costs will decline as the probability of litigation delays is reduced and questions regarding mitigation standards are definitively resolved. Net financial benefits to the private sector of the state's economy will in turn increase revenues to state and local governments.

- **Local Government Planning**

Local governments are required to plan to meet demand resulting from population growth under the state Growth Management Act. Reliable and affordable water supplies simplify this process for local governments by reducing cost uncertainty associated with acquiring new sources of water. As a result, governments can improve cost estimates and better assess the adequacy of existing revenues to pay for alternative service levels.

- **Public Services and Utilities**

As population and economic activity increase, so will the demand on public infrastructure increase. Schools are likely to be required to serve more children. Roads will carry more traffic. Sewer systems will experience higher volumes. In general, greater demand for public services can be expected to result from adoption of the preferred alternative.

While it is certainly reasonable to assume the demand for public goods will increase as a result of the adoption of the preferred alternative, it is not clear that the capacity of existing infrastructure to absorb the increasing demand for services would be exceeded. As a result, it is not possible to assess the extent to which new school facilities, roads, sewers and other infrastructure would need to be built. Should demand eventually exceed the ability of the existing public infrastructure to deliver services, incremental investment would be required. The costs of any incremental investment in public infrastructure would be offset at least in part by tax revenues resulting from increased economic activity, as discussed below.

- **Reduced Transaction Costs**

Applicants for new water rights can reasonably expect lower transaction costs as a result of adopting the proposed rule. Current delays in processing rights can last 10 or more years as consultation with affected interests regarding mitigation requirements and litigation run their course. The effective resolution of questions related to mitigation eliminates the need for ongoing case-by-case consultations while significantly reducing the likelihood that any individual water right would be subject to litigation regarding the adequacy of mitigation. Processing time for permit applications should be determined preponderantly by the capacity of staff at the Department of Ecology to issue decisions.

- **State and Local Government Revenues**

Based upon the economics analysis developed by the University of Washington (Huppert, 2004), the state Office of Financial Management and Department of Revenue determined the revenue impacts to the state General Fund resulting from the adoption of the proposed rule. In short, these agencies found that the state can expect an additional $40 million per year in tax revenue to result from allocation of water under the proposed rule. Initially, receipts would be lower and increase over time as development occurred. Local governments would be expected to experience increase collections as well.

IMPACTS ON THE NATURAL ENVIRONMENT

Impacts on the natural environment will occur as a result of agricultural, municipal and industrial water uses. Increased population is likely to convert lands to housing and commercial services that are currently in other uses, including open space and agricultural uses. Agricultural practices are likely to shift from dry land crops to irrigated crops to capture higher returns on investment. Wildlife relying on current land use patterns may suffer from reduced habitat opportunities. Water quality impacts are expected to be minimal, occurring only to the extent that additional water in the river requires incremental spill at federal dams. Air quality is likely to require additional management attention as increased population and economic activity generate additional combustion byproducts and particulate dispersal in the atmosphere.

- **Land Use**

Two types of land use changes are likely to occur as a result of adopting the preferred alternative. First, additional urban and suburban land use patterns are likely to emerge as water is allocated to meet the needs of an increased population and industrial users. While it is not possible to determine the extent to which incremental investments in public infrastructure will be required as a result of increased economic activity, demand for public services (roads, sewers, schools, etc.) can be expected to grow.

Second, agricultural land uses are likely to shift from dry land to irrigated cropping.

- **Effective Mitigation**

One of the goals of the Columbia River Initiative is to reduce the risk to fish in critical low-flow periods. The proposed state program is designed to ensure that new water uses are not only mitigated during critical low-flow periods, but that flows are actually enhanced as a result of program implementation. As previously described, this is accomplished by limiting the quantity of water that can be allocated by the state to two-thirds of the amount acquired through purchases of water rights, and investments in water conservation and storage. As a result, negative impacts to streamflows are not an expected outcome of adopting the preferred alternative.

- **Water Quality Impacts**

The temperature of the Columbia River is partially dependent on flow. Under the proposed Columbia River Initiative, two-thirds of the total water deposited into the Account is available for offstream uses and one-third is permanently held in trust solely for instream uses. Also, the likelihood of a shift to proportionally more withdrawal in summer is unlikely. Therefore, the Columbia River Initiative should not affect temperature in the Columbia River since the anticipated net effect on instream flow should be an increase in flow as the initiative is implemented.

There are two times during the year that are of particular interest for Total Dissolved Gas (TDG). The first is spring spills from March/April through June (the exact timing varies each year). During this time period, water is spilled over dams both for fish passage (voluntary spills) and to release excess water (involuntary spills). The TDG levels occasionally exceed the maximum criteria set in the water quality standards. As the Columbia River Initiative increases the amount of water in the river during this time period, it could result in more involuntary spills, which could cause a slight increase in the amount of TDG.

The second important time for TDG is the July and August low-flow time period. The TDG levels rarely exceed the criteria during this time period. However, increasing TDG levels might still have a small impact on aquatic life depending on exposure and duration. Currently, fish spills during this time period are based on a percentage of the total flow of the river. This spill program is part of a Biological Opinion for river operations. Any changes in the spill program could change the relationship between withdrawals and TDG. Since the Columbia River Initiative would increase the amount of water in the river during this time period, it would result in slightly more water available for hydropower generation or slightly more spill under the current program, which could cause a slight increase in the amount of TDG.

- **Air Quality**

Air quality is likely to be degraded to some extent. Increased population can be expected to generate more vehicular travel and, as a result, more combustion byproducts in the air. Growth in economic activity would have a similar effect on vehicle emissions. Increasing population and industrial activity will also further disperse particulates in the atmosphere. Changes in agricultural practices may or may not increase emissions and particulates, depending upon the demands of alternate crop types.

- **Wildlife Habitat**

The state can expect some negative effect on wildlife resulting from adoption of the proposed rule. Affected species are likely to suffer from reduced habitat as urban and suburban development occurs, and as land is shifted from dry land to irrigated agricultural practices.

Mitigation Measures

Mitigation is the primary tool available to policymakers to offset the negative effects of decisions that are otherwise beneficial to the state. This section of the EIS for the proposed Columbia River water resources management program presents the mitigation strategies that will be employed to offset impacts to the built and natural environment resulting from the adoption of the preferred alternative.

In most cases allocating water for off-stream use results in reduced streamflows. Accounting for this fact and mindful of the recommendations of the National Academy of Sciences, the preferred alternative is designed to ensure that more water is available instream during the critical season for salmon migration than would otherwise be available. As a result, the proposed programmatic rule-making is self-mitigating and would require no further action to protect the natural environment.

Because allocation of water under the proposed rule and legislation would only occur if adequate mitigation water has been acquired by the state, an adequate budget is required for successful implementation of the preferred alternative.

The proposed rule-making can be expected to result in negative impacts in the natural environment. These impacts include increased conversion of land to urban and suburban uses, marginally reduced local air quality, and reduced water quality.

It is expect that land use related impacts can be addressed in existing local government planning processes under the Growth Management Act. Increased demand for public infrastructure and services can be supported, at least in part, by increased tax revenues generated by economic growth.

Air quality impacts, to the extent that a problem is created, can be expected to be managed by existing state and local air quality management agencies.

Water quality impacts, again marginal in nature, will be addressed in the context of state and federal water quality planning efforts currently under way for the mainstem of the Columbia River (Columbia TMDL process). The marginal effects resulting from the CRI are unlikely to be measurable in the context of the major sources of temperature and gas pollution.

Wildlife impacts will need to be assessed by the Department of Fish and Wildlife to determine the need for state action to improve or acquire and protect remaining wildlife habitat.

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Ecology maintains an e-mail listserv for the Columbia River Initiative (CRI) and for the Ecology's Water Resources Program. E-mails announcing the scoping of the EIS and the issuance of the draft EIS were mailed to these listservs. There are approximately 150 subscribers on the CRI e-mail list (as of 4/19/2004) and 378 on the Water Resources email list (as of 12/15/04). Notification that the draft EIS is available for comment was also mailed to 379 interested parties.

Appendices

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Glossary and List of Acronyms

AF/Y	Acre-feet Per Year
CFS	Cubic Feet Per Second
CRI	Columbia River Initiative
DEIS	Draft Environmental Impact Statement
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
GPM	Gallons Per Minute
NOAA Fisheries	National Oceanic and Atmospheric Administration – Fisheries Division
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
TDG	Total Dissolved Gas
USGS	United States Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Watershed Resource Inventory Area